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MACHINE DESIGN
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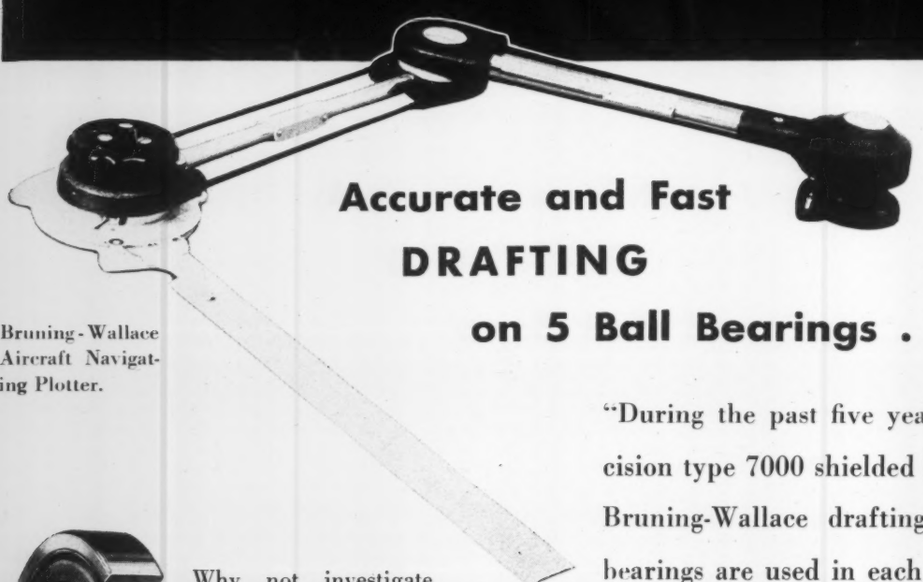
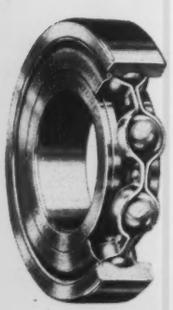
Bruning-Wallace Drafting Machines in use at Lockheed Aircraft Corporation.



Bruning-Wallace Aircraft Navigating Plotter.

Accurate and Fast DRAFTING on 5 Ball Bearings . . .

"During the past five years we have used your precision type 7000 shielded bearings in our well-known Bruning-Wallace drafting machine. Five of these bearings are used in each machine where they effectually minimize any friction that would occur at the joints and pivot points of our band and pulley type drafter. The performance speaks well for the consistent quality of your product."—Vard B. Wallace.



Why not investigate what these anti-friction bearings can do for your mechanism? New Departure's products are *ideas* as well as ball bearings.

2800

NEW DEPARTURE Ball Bearings

New Departure • Division General Motors Sales Corporation • Bristol, Connecticut

NOTHING ROLLS LIKE A BALL

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CLASSIFIED FOR CONVENIENCE WHEN STUDYING SPECIFIC DESIGN PROBLEMS

KEY: EDIT., EDITORIAL PAGES; ADV., ADVERTISING PAGES; R, RIGHT-HAND COLUMN; L, LEFT-HAND COLUMN

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THE BIRTH OF A BEARING

FAFNIR

The father of a few children who amount to something has done mankind a greater service than the father of thirteen, if he aims most of his brood toward reform school.

It's the same way with ball bearings. An over-zealous bearing manufacturer, at the whims of an over-anxious bearing user, can produce a lot of unhappy "children". . . .

Bearings whose place in the world of industry is so limited that, from birth, they're headed for an early death or quick reform.

Fafnir measures completeness of line in *usefulness* rather than numbers alone. That is why the birth of a bearing is important at Fafnir, for each new arrival is destined for a key place in a big, healthy, successful family.

Glance at the Fafnir literature shown at the left. See how the Fafnir line—*the balanced line—most complete in America* — is divided. Not into thousands of individual designs of limited application, but into carefully-planned groups of bearings, each designed to serve a given industry — and serve it completely.

The Engineering Catalog covers the Fafnir standard line — complete in range of types and sizes — which eliminates in nine cases out of ten the cost, delay and grief that goes with designing a special bearing. And Fafnir's specialized lines, proved in performance, provide bearings ready to go to work in specialized applications — and to deliver.

It takes only a few seconds now to get acquainted with these Fafnirs. Select, on the opposite page, the descriptive literature you want, and write to the Fafnir Bearing Company, New Britain, Connecticut.

BALANCE IN DESIGN

In ball bearing design, ball size, race depth and ring thickness determine life and capacity.

Fafnir's larger balls carry greater load; make fewer revolutions per bearing revolution, with resultant longer life. Fafnir's deeper races also increase load capacity, and provide thrust capacity to a degree unusual in a radial bearing.

Every Fafnir Ball Bearing has been developed to the point where high capacity and long life are inherent attributes of a perfectly balanced design.

Modern

AS THE "WORLD OF TOMORROW!"

Modern in appearance, with its rounded, molded cover . . . modern in action, with its larger, handier buttons, shrouded to prevent being operated accidentally. The new Type SD Westinghouse push button gives both added appearance and performance at the vital "contact point" on machines.

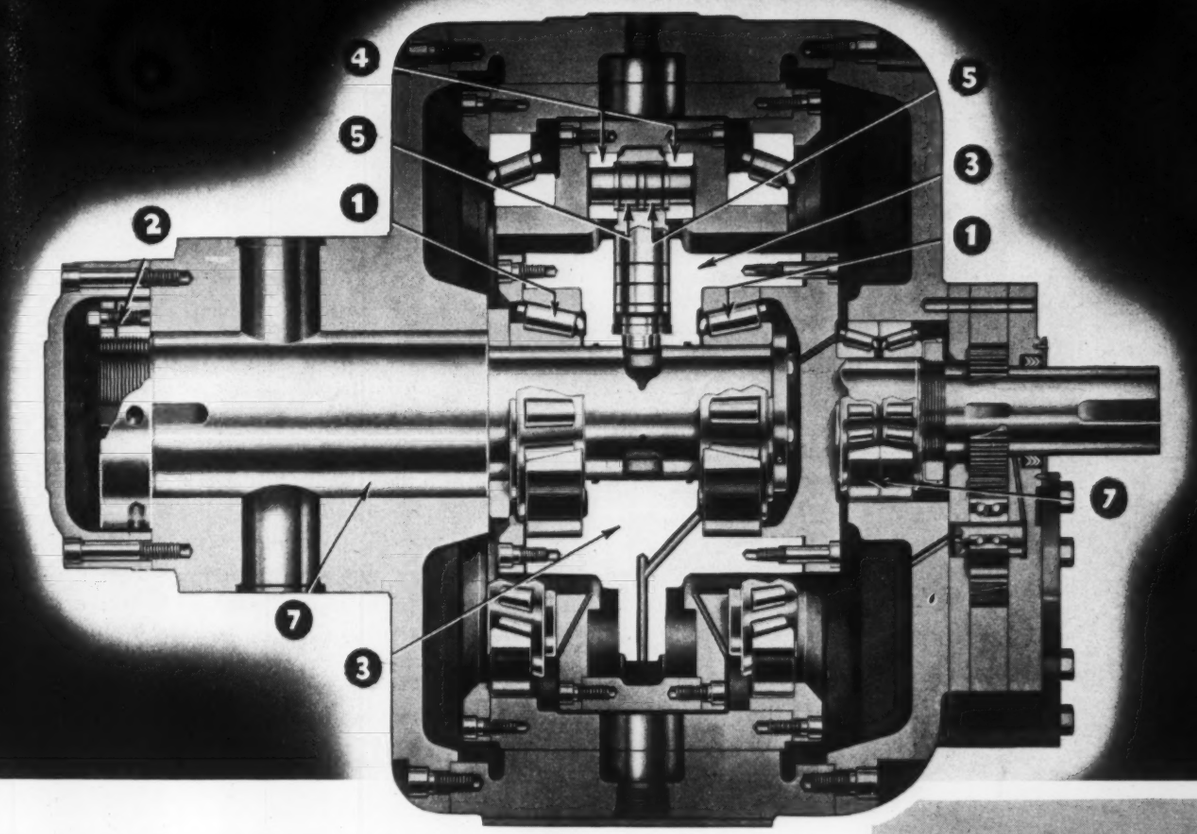
Installation is easy — clearly marked terminals prevent mistakes. Application problems are simplified — one, two and three-button types, both enclosed and as units for built-in uses, make selection easy. Write for the new Westinghouse bulletin 15-020 showing the types of these standard duty push buttons available.

ROTARY SELECTOR SWITCHES
A 3-point hand-off-automatic switch with the modern lines and appearance of the new Westinghouse Push Button stations.
HAND
AUTO
DUST AND WATERTIGHT PUSH BUTTONS
New Type SD push buttons in cast-iron enclosures provide units for outdoor or other exposed applications.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Dept. 7-N. J-20881

Westinghouse *Type SD* Push Buttons

A RADIAL PUMP THAT *IS* DIFFERENT!



AND HERE ARE THE REASONS WHY

The HYDRO-POWER RADIAL PUMP – the heart of THE HYDRO-POWER HYDRAULIC SYSTEM OF OPERATION – is not to be compared with radial pumps of conventional design. The HYDRO-POWER RADIAL PUMP is different – in principle – in operating efficiency – in the long life service it renders to all types of hydraulic actuated presses and machinery. It offers, in addition to variable and reversible delivery, a new relationship between the pintle and rotor which, with the aid of heavy, precision type, adjustable tapered roller bearings, assures perfect alignment of these two members – complete mechanical separation – with close clearance. Only a HYDRO-POWER RADIAL PUMP can provide machinery builders with these desirable features which add so materially to its life and dependable, continuous service. This is substantiated by proven performance on hundreds of installations in many diversified industries. Every press or machine that can use a hydraulic pressure generator to advantage deserves the extra efficiency and assurance HYDRO-POWER RADIAL PUMPS will give them. A HYDRO-POWER machine drive engineer is at your service in determining the most practical application.

HYDRO-POWER SYSTEMS, INC. Mount Gilead, Ohio, U. S. A.

1 — Patented positive mechanical separation at necessarily close clearance alignment between rotor and pintle through use of ultra-precision tapered roller bearings.

2 — Permanent maintenance of this close mechanical separation through patented adjustment (from outside of housing). Compensates for bearing wear.

3 — Cylinder rotor CENTRIFUGALLY cast, of manganese bronze – assures homogeneous metal structure.

4 — Large manganese bronze segmental piston thrust shoes with liberal bearing area for low bearing pressure on larger sizes.

5 — Double roller bearing mounting between piston and wrist pin assembly on larger sizes.

6 — ALL working parts of manganese bronze or electric steel forgings hardened and ground.

7 — Pintle supported rigidly at BOTH ENDS – no cantilever deflection.

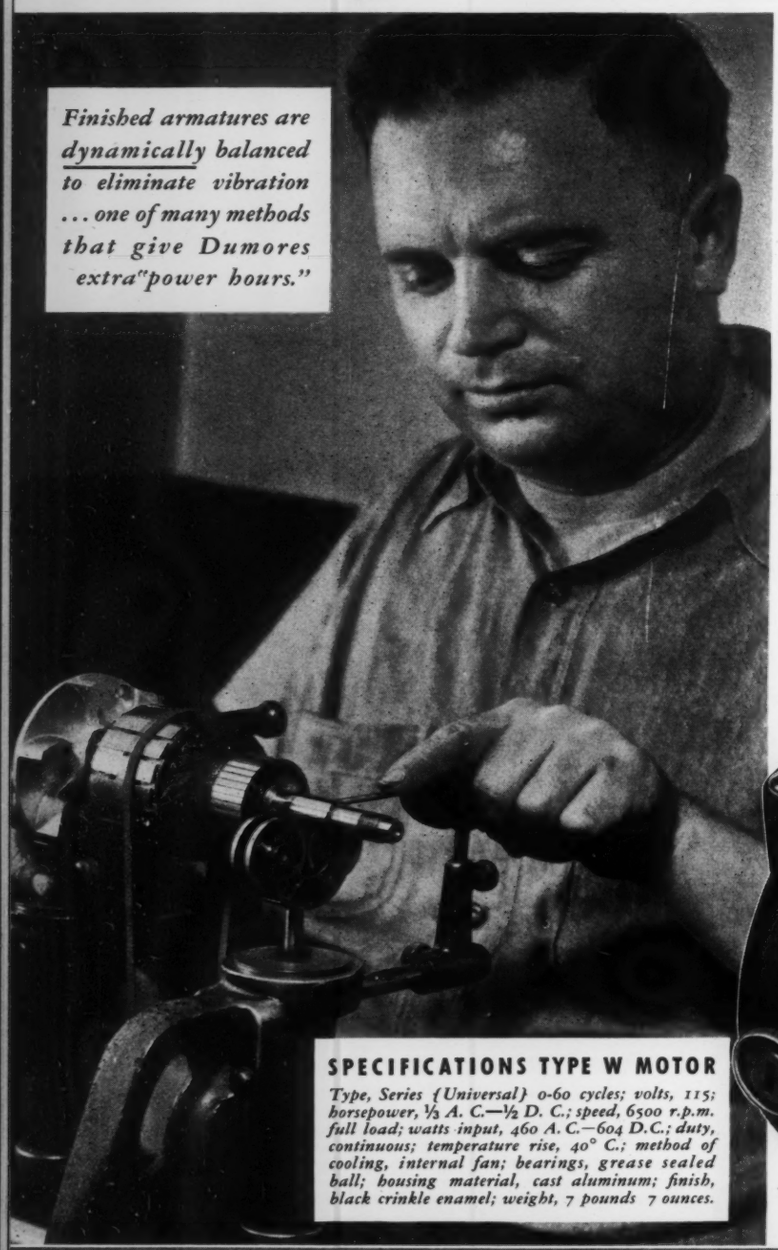
Streamline appearance – designed for modern conditions inside and out.

HYDRO-POWER SYSTEMS, Inc.

MODERN DRIVES • FOR MODERN MACHINERY

MOUNT GILEAD, OHIO, U.S.A.

THERE ARE 5 quarts IN A DUMORE GALLON



Finished armatures are dynamically balanced to eliminate vibration ... one of many methods that give Dumores extra "power hours."

SPECIFICATIONS TYPE W MOTOR

Type, Series {Universal} 0-60 cycles; volts, 115; horsepower, ⅓ A. C.—½ D. C.; speed, 6500 r.p.m. full load; watts input, 460 A. C.—604 D.C.; duty, continuous; temperature rise, 40° C.; method of cooling, internal fan; bearings, grease sealed ball; housing material, cast aluminum; finish, black crinkle enamel; weight, 7 pounds 7 ounces.

Long after many a motor runs out of "gas" and gives up the ghost, a Dumore will keep right on going . . . fresh as a sprinter getting his second wind. Dumore's reputation for delivering extra "power hours" is the reward of employing sound, accurate manufacturing methods — tried and proved by 25 years of relentless research and exhaustive field tests.

Religiously employed by skilled workmen long experienced in the Dumore plant, these methods include: (1) Dynamic balancing of armatures to eliminate vibration (2) Swaging of commutator leads for 100% electrical contact by special Dumore process (3) Grinding of commutators concentric with bearings for longer brush life (4) Expanding of armature windings, then double sealing, to prevent centrifugal "breathing" (5) Inspection of motors 5 times in manufacture and running in to seat brushes properly.

Add to the life of your product with any one of Dumore's AC—DC motors . . . 1/500 to 2/3 h. p. . . . 0 to 60 cycles. Dumore engineers will gladly help you in adapting the correct unit for your particular needs. Dumore's tailor-made motor parts are available for special adaptations. Write for facts and engineering service application blank.

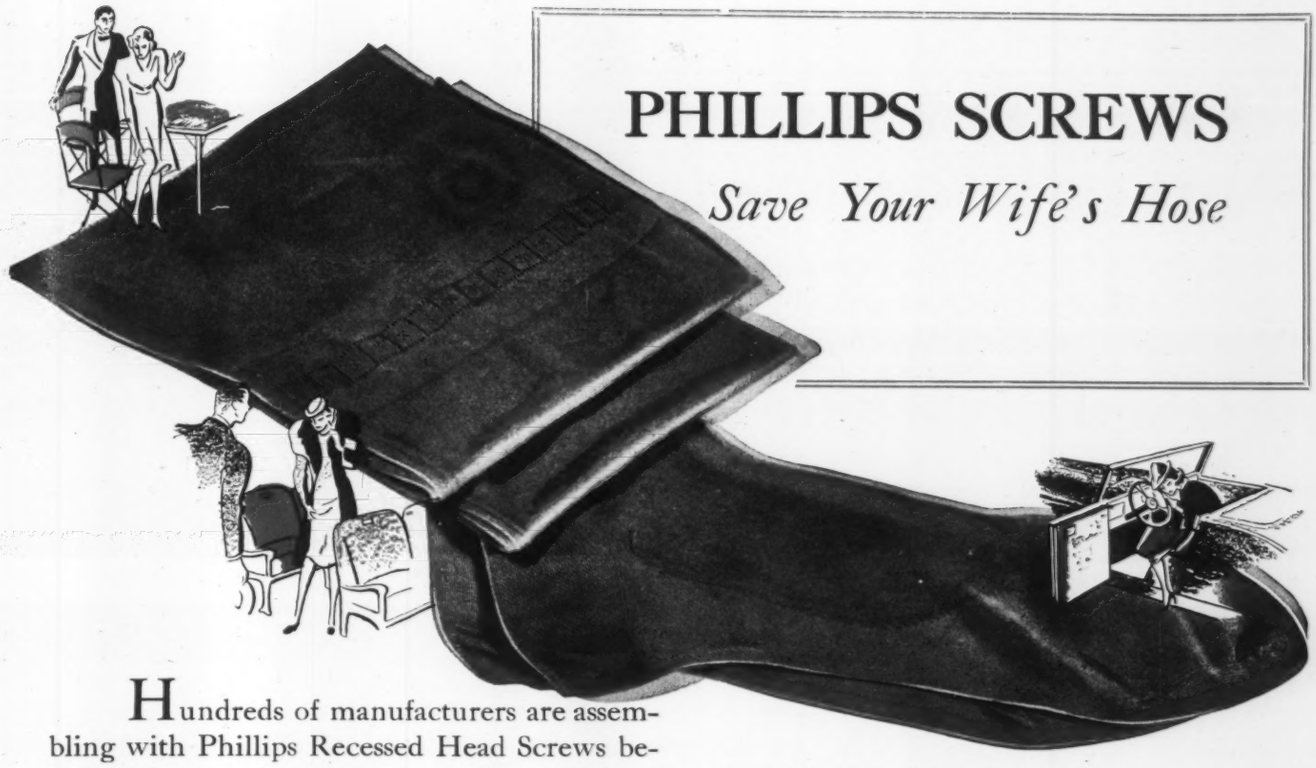
THE DUMORE CO., Dept. 129-K Racine, Wis.

DUMORE MOTORS

FOR *Extra* POWER HOURS

PHILLIPS SCREWS

Save Your Wife's Hose



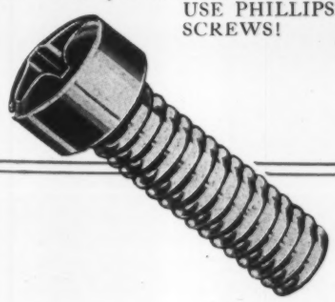
Hundreds of manufacturers are assembling with Phillips Recessed Head Screws because they cost less to use . . . and have gained an extra sales point for their products.

The precision fit of Phillips Driver and Phillips Screw prevents shearing the metal on the edge of the recess — so there's no danger of jagged burrs tearing clothing. Phillips Screws set up tighter — there's increased resistance against loosening. Better appearance. A quarter turn lines up when necessary.

People are getting the idea that Phillips Screws, appearing on so many better-quality products, are evidence of better care in manufacturing—a better value for their dollars. No wonder salesmen are being instructed to point out that Phillips Recessed Head Screws have been used!

YOU CAN SAVE UP TO 50% AND MORE IN ASSEMBLY COST!

Power drivers used more often — there's no danger of slipping driver. No pilot holes, no crooked screws, no burrs to file. Manufacturers of aircraft, automobiles, electrical appliances, assembled metal goods, furniture — all say IT COSTS LESS TO USE PHILLIPS SCREWS!



PHILLIPS SCREWS SET UP FLUSH WITHOUT HEADS SPLITTING

The shape of the Phillips recess was designed, after months of research, to utilize the driver's maximum turning power without sacrifice of strength in the screw's head. Note flat surfaces — no sharp corners — that's why Phillips Screws can't be burred. 4 sizes of Phillips Drivers provide greatest efficiency over entire range of Phillips Screw sizes. 2 driver sizes fit diameters #5 to #16.

THIS BOOKLET will help your plant to cut assembly costs up to 50% and more. Address one of the firms below for free copy.

PHILLIPS

RECESSED HEAD SCREWS

MACHINE SCREWS · SHEET METAL SCREWS · WOOD SCREWS · STOVE BOLTS

U. S. Pat. on Product and Methods No. 2,046,343; 2,046,837; 2,046,839; 2,046,840; 2,082,085; 2,084,078; 2,084,079; 2,090,338
Other Domestic and Foreign Patents Allowed and Pending

American Screw Co., Licensor, Providence, R. I.
Chandler Products Company, Euclid, Ohio
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corporation, New Britain, Conn.
The Lamson & Sessions Co., Cleveland, Ohio
National Screw & Mfg. Co., Cleveland, Ohio
Parker-Kalon Corporation, New York, N. Y.
Pheoll Manufacturing Company, Chicago, Illinois
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Lock Washer Company, Chicago, Ill.

IT COSTS LESS TO USE PHILLIPS SCREWS

A TOUGH JOB!

Only Helical Spring Washers can keep these bolts tight!

Exclusive advantages in Helical Spring Washers, assuring bolt tightness under ALL conditions, *cost nothing extra!* Live Action...Adequate Power...Long Range ...these are *essentials* in compensating for the causes of initial looseness.

Your product will last longer if bolts remain tight. Specify Helical Spring Washers—their Live Action is free!

SPRING WASHER INDUSTRY
616 Wrigley Building • Chicago, Ill.

Concrete mixers can expect little mercy from hammering shocks and incessant vibration! Bolts MUST be kept tight—Helical Spring Washers are the accepted standard.

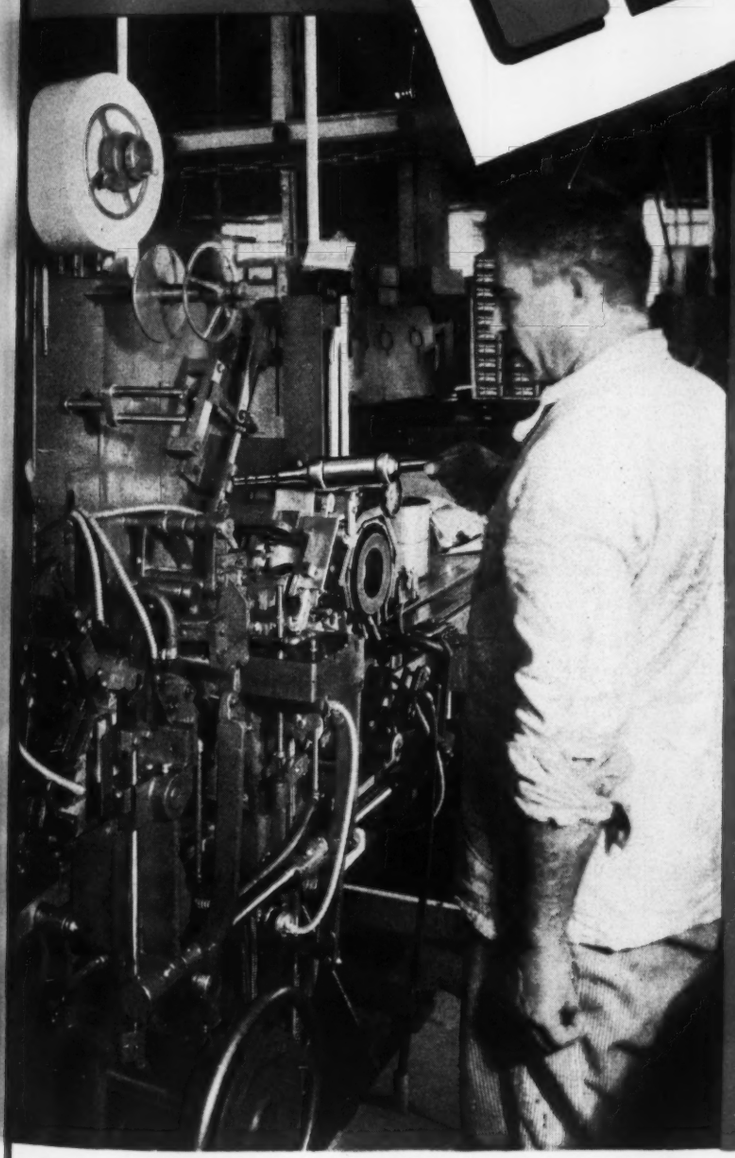
ONLY A HELICAL SPRING WASHER HAS LIVE ACTION

"ALEMITE EQUIPMENT IS FAST, SAFE, ECONOMICAL . . .

BUT ABOVE ALL, IT'S

CLEAN!

SAYS LIFE-SAVERS, INC.



Saves 16 Labor-Hours per Week!

INADEQUATE lubrication of a single bearing on the machines that make and wrap Life Savers *could result in costly repairs and expensive production delays.* On the other hand, one drop of oil on a package of Life Savers wouldn't improve the flavor. So Life-Savers, Inc., use Alemite Lubrication Equipment *to keep machines operating at peak efficiency*—and *to keep their product CLEAN!* Lubricant goes *into* bearings—not onto the product!

Give the machines you make the manifold advantages of Alemite Lubrication! Build satisfaction and keep down service costs by making it *easy* to lubricate them *correctly.* Enable your customers to avoid expensive contamination waste by providing this modern lubrication which keeps products *clean.* And don't overlook the economy of Alemite Lubrication—*a clear saving of 16 labor-hours a week* in lubrication time, in the case of Life-Savers, Inc.

Alemite Engineers are eager to co-operate with you in solving any lubrication problem which may arise in connection with machine design. Feel free to write—without obligation!

ALEMITE

REG. U. S. PAT. OFF.

A Division of Stewart-Warner Corporation
1804 Diversey Parkway, Chicago, Illinois
Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ontario

WORLD'S LARGEST MANUFACTURER OF LUBRICATION PRODUCTS

Alemite Electric Power Gun Model 6190

Holds 25 lbs. of plastic lubricant; delivers 12 oz. per minute under pressure of 4500 to 5000 lbs. per sq. in.; heavy duty universal electric motor; easily portable; complete with hose and cord.

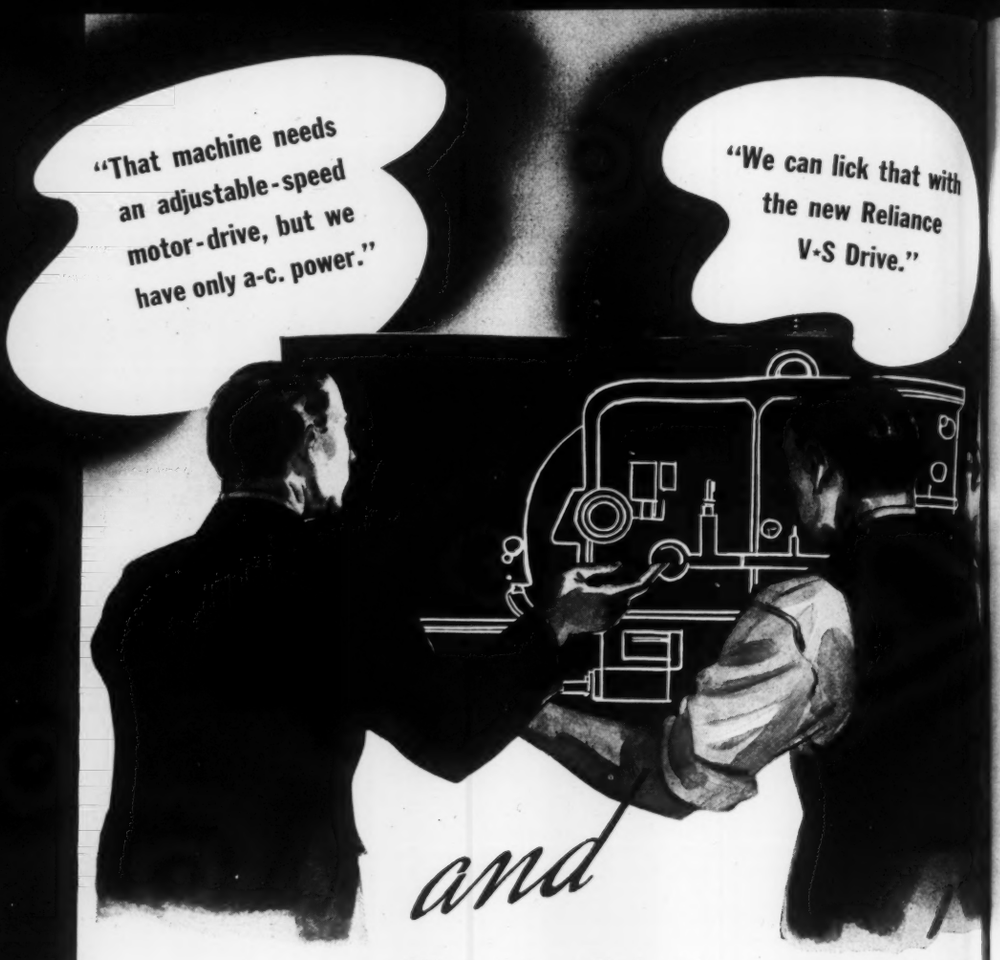
Alemite Filler Tank Model 6425

Used to refill hand guns in Life-Saver plant. Holds 35 lbs. lubricant. Pumps 1 pound to each 7 strokes. Permits easy, fast, clean loading of Alemite Hand Guns without exposing lubricant to contamination.

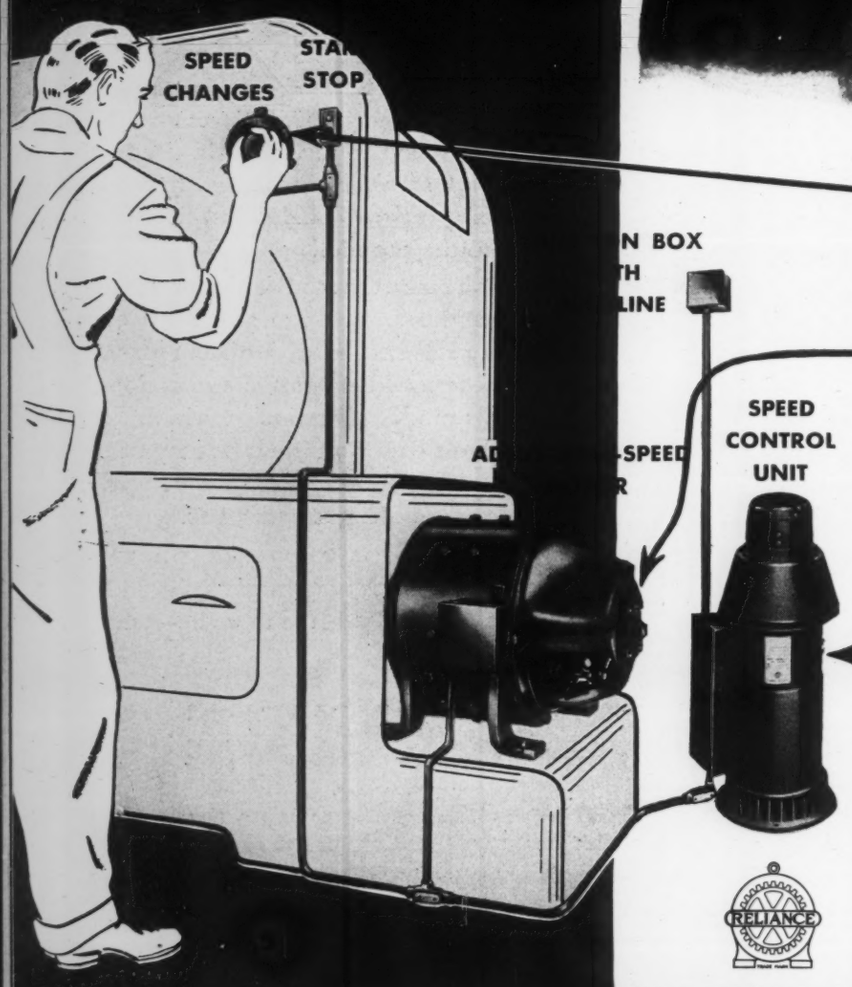
Alemite "Rock Crusher" Gun Model 6524

Exclusive patented helix arm and worm positively prevents air pockets. Holds 40 lbs. lubricant—fibrous, plastic, or viscous; develops pressure of 5000 lbs. per sq. in. Easily portable.

RELIANCE V⊙S DRIVE


"That machine needs an adjustable-speed motor-drive, but we have only a-c. power."
"We can lick that with the new Reliance V•S Drive."

and



There are no limitations on convenience. The start-stop button and speed adjuster can be placed anywhere that a wire can be run. They are so compact that they can be grouped with other control elements for the machine.

The drive will require a minimum of space because it will be direct without intermediate speed-changing devices. The speed range can be anything up to 12 to 1 with smooth changes from high to low limits.

Other features which have a direct bearing on production are these: quick stopping, speed setting, safe speeds for threading and inching, ample starting torque for all conditions.

All these are now made possible at a new low price by the "packaged" V•S Speed Control Unit which is connected by three wires to the 3-phase a-c. power circuit. Of vertical construction, it takes little space and can be mounted anywhere.

Reliance Electric & Engineering Co.
1079 Ivanhoe Road **Cleveland, Ohio**

Birmingham, Boston, Buffalo, Chicago, Cincinnati, Detroit, Greenville, (S. C.), Los Angeles, New York, Philadelphia, Pittsburgh, Portland, (Ore.), St. Louis, San Francisco, Syracuse, (N. Y.), and other principal cities.

RELIANCE ELECTRIC & ENGINEERING COMPANY, 1079 IVANHOE ROAD, CLEVELAND, OHIO

I should like to receive a copy of your Bulletin 307, which tells about your new Reliance V•S Drive.

Name_____ Title or Dept._____

Company_____

Street_____ City_____ State_____

SAFE! • WE FILTER FOR YOUR HEALTH

There are no foreign particles in the solutions which give the pleasing flavor to the tobacco of your favorite cigarettes. Cuno *continuously cleanable* filters take them out . . . protecting *you*, as well as the fine spraying equipment used by the industry.

CUNO CONTINUOUSLY-CLEANABLE FILTERS BRING MORE ECONOMY TO YOUR DESIGN

You can make savings on the fluid you need to strain. No matter what it is, nor how much or how little of it there is, a Cuno *continuously cleanable* filter can handle it for you *more* economically.

Cuno filters can be made of any machinable metal. Briefly, they consist of a series of accurately spaced metal discs with cleaner blades between. The filter can be built, and the discs spaced, to suit your job. What have you, air, oil, gas, water, acid — name it. We'll give it (and you) continuous protection . . . continuous savings from lost working time . . . a healthier balance sheet.

OF INTEREST TO DESIGN ENGINEERS

Write for "80 Ways to Make More Money." It's yours free, if you'll use the coupon below, and it gives actual case studies taken from famous companies in *your* industry.

Cuno Engineering Corporation
270 South Vine Street
Meriden, Connecticut
Please send me, free, "80 Ways to Make More Money."

Name.....

Company..... City..... State.....

Street.....

avoid stop and go with **CUNO** *Filters*

CUNO ENGINEERING CORPORATION ★ MERIDEN, CONNECTICUT

Announcing THE UNION OF TWO OF AMERICA'S INDUSTRIAL PIONEERS

The Chain Belt Company of Milwaukee announces the merger of all the business, plants and equipment of the Baldwin-Duckworth Chain Corporation of Springfield and Worcester, Massachusetts, with those of Chain Belt Company.

The consolidation of these two firms, each with a successful history of continued growth and financial strength, welds together an exceptionally complete and well-established line of drive and conveyor chains and transmission equipment.

Since its inception, Chain Belt Company, its engineers and its corps of "*How to Handle It*" men have pioneered in the constant progress of chain design and application.

The Baldwin-Duckworth division of Chain Belt Company and the "*B-D*" men have a similarly inspiring record in the development and use of machine finished roller chains.

For these companies a new frontier is opened, a new era begins. The progressiveness of thought and action that made each a first line company in its own right promises even more through this new unity of effort.

From this union, new improvements will emerge to join with Rex's Z-Metal, Durobar, Pumpcrete, Baldwin-Duckworth's Master, Full-Flex, and other "*B-D*" products, in pushing back the materials and power handling frontiers existing in every industry today.

CHAIN BELT COMPANY

BALDWIN-DUCKWORTH CHAIN DIVISION • **REX CHAIN AND CONVEYOR DIVISIONS**

Springfield, Mass. • Worcester, Mass. — **Milwaukee, Wisconsin**

'I THOUGHT THEY WERE PASSING THE BUCK!'

1 **Was I burned up** when the air pressure failed again! "You couldn't pay me to keep a machine like that new compressor!" I yelled.

2 **I called** the Tornado Compressor Company*: "Your new compressor wouldn't pump up a bicycle tire," says I. "It sounds funny and won't come up to pressure. What can you do about it?"

3 **"So they claim** something is wrong with the motor!" I fumed. "Sounds to me like passing the buck. What I want is air pressure—not excuses!"

4 **In a few hours,** though, in walks a G-E engineer. "The Tornado Company tells us you're having trouble with a G-E motor," he says. "Let's have a look at it."

5 **I hadn't realized** how low the voltage was until he showed me his tests. We were trying to run the compressor on an already overloaded lighting circuit. Nothing was really wrong with the compressor unit.

6 **It runs like a song** with new wiring. Now I'm glad to tell anyone: "You can't beat a Tornado Compressor, especially when it's equipped with a G-E motor."

THIS true account is typical of the way G-E service builds good will for machinery manufacturers whose machines are G-E equipped.

No matter where your customers are located, they can always get quick service from our sales engineers in 103 cities, our 28 warehouses, and our 25 service shops. Charges for such service calls are extremely reasonable.

Are you *now* in need of any information on electric equipment? Perhaps a discussion of your requirements with our engineers might help you iron out an electrical design problem. Just call our nearest office or write to General Electric, Schenectady, New York.

**TORNADO is not the manufacturer's real name, of course.*

NEW YORK WORLD'S FAIR—SEE THE G-E "HOUSE OF MAGIC"—SAN FRANCISCO EXPOSITION

GENERAL ELECTRIC

011-539

Left—G-E 7 1/2-hp, 284-frame, standard induction motor.
Length—22 5/8 inches
Height—14 inches
Width—14 inches

Right—G-E 7 1/2-hp, 284-frame, single-reduction gear-motor.
Length—25 11/16 inches
Height—14 inches
Width—14 inches

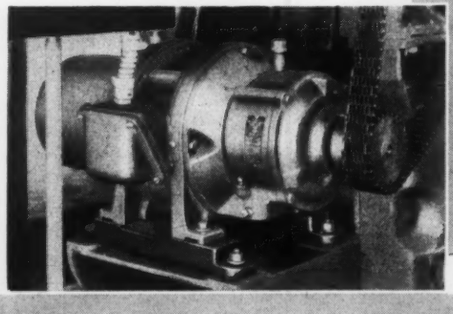
G-E GEAR-MOTORS SAVE SPACE ON LOW-SPEED APPLICATIONS

THE use of G-E gear-motors to drive low-speed equipment, such as machine tools, conveyors, pumps, agitators, mixers, and other low-speed machinery, has enabled many companies to simplify design, save valuable space, and thereby obtain greater, more efficient production.

The G-E gear-motor consists of a highly efficient planetary gear-reduction unit built into the drive end of a standard, normal-speed motor. It combines the desirable features of a normal-speed motor with those of a simple, efficient, compact reduction gear to give practically any desired low speed.

You will find it easy to select the right gear-motor for your low-speed drive problems from our complete line—1/8- to 75-hp, 6- to 600-rpm, available in many types of mechanical and electrical modifications.

It will be well worth your while to investigate the many advantages obtainable by the use of G-E gear-motors for your low-speed drives. For further information, call our nearest representative or write General Electric, Schenectady, N. Y.



Simplification of design was achieved on this machine by this totally enclosed gear-motor

Features of G-E Gear-motors

1. Standard ball-bearing motor—polyphase, single-phase, or direct-current—held in concentric alignment with gears by rabbet-fit assembly of gear casing on motor frame.
2. Helical-cut planet gears mesh with internal ring gear with the minimum of sliding or friction contact.
3. Motor shaft supported by its own bearings, independent of the gear assembly.
4. Planet cage is supported by its own bearings, widely spaced to give positive alignment and to provide for overhung loads.
5. Low-speed shaft of ample proportions—a steel forging integral with the head of the planet cage.
6. Center driving pinion integral with the motor shaft. All gears are of the helical type in order to provide continuous tooth contact. This contributes to high efficiency, long life, and smooth operation.
7. Oil-return groove adds to the effectiveness of the oil-circulation system.
8. Large oil well, provided with oil filler on top and a drain plug, affords ample splash lubrication.

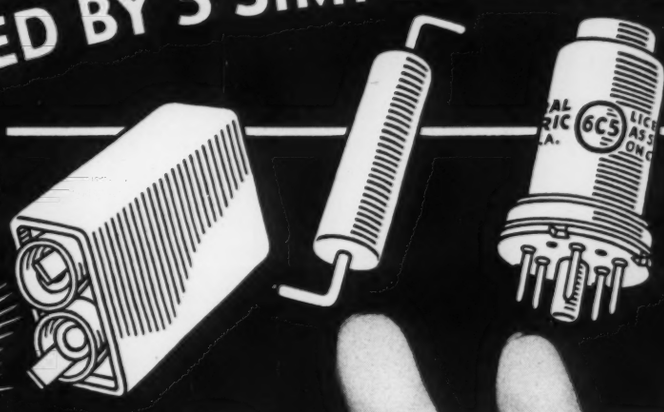
GENERAL ELECTRIC

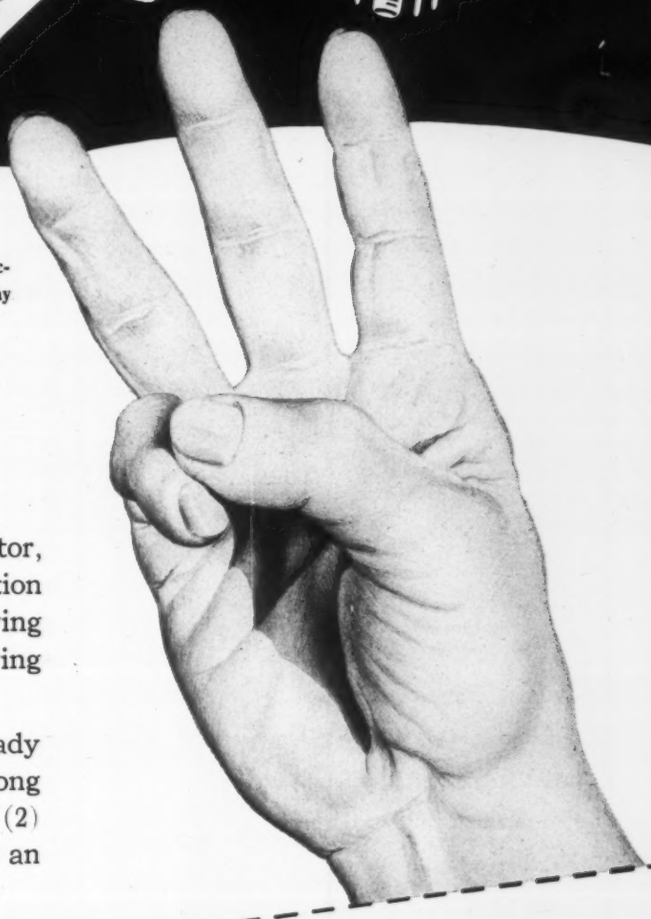
020-390

Dependable Timing

ASSURED BY 3 SIMPLE ELEMENTS

The new CR7504-A1A vacuum-tube time-delay relay for automatic timing





THREE ELEMENTS—a capacitor, a resistor, and a vacuum-tube—perform the timing function in this new timer. None of them contain moving parts to wear and require adjustment. The only moving part in the timer is the contact of a small relay.

This timer has had a remarkably quick acceptance. Already it is standard equipment on dozens of machines, among which are: (1) an automatic high-speed radius grinder; (2) a lapping grinder; (3) a plastics-molding machine; (4) an automatic trimmer; (5) a welding machine.

Its features are numerous. Time adjustment is made by a convenient knob in the cover. The use of an electronic circuit means that noise during timing is eliminated. Here are some other characteristics of the relay:

Range of Adjustment—5% to 100% Maximum timing	
Six Forms—Maximum time of 120, 60, 12, 3, and 0.9 seconds at 115 volts (20% higher at 230 volts)	
Contact Rating	Normal— 1 amp at 115 volts—0.5 amp at 230 volts
	Special—10 amp at 115 volts— 5 amp at 230 volts

Dept. 6A-201, General Electric, Schenectady, N. Y.

Please send me the following data on your vacuum-tube time-delay relay:

1. *Publication GEA-2902A, describing and illustrating it.*
2. *Sketch GES-2227, showing how one user applied the timer to control the grinder.*

Name.....

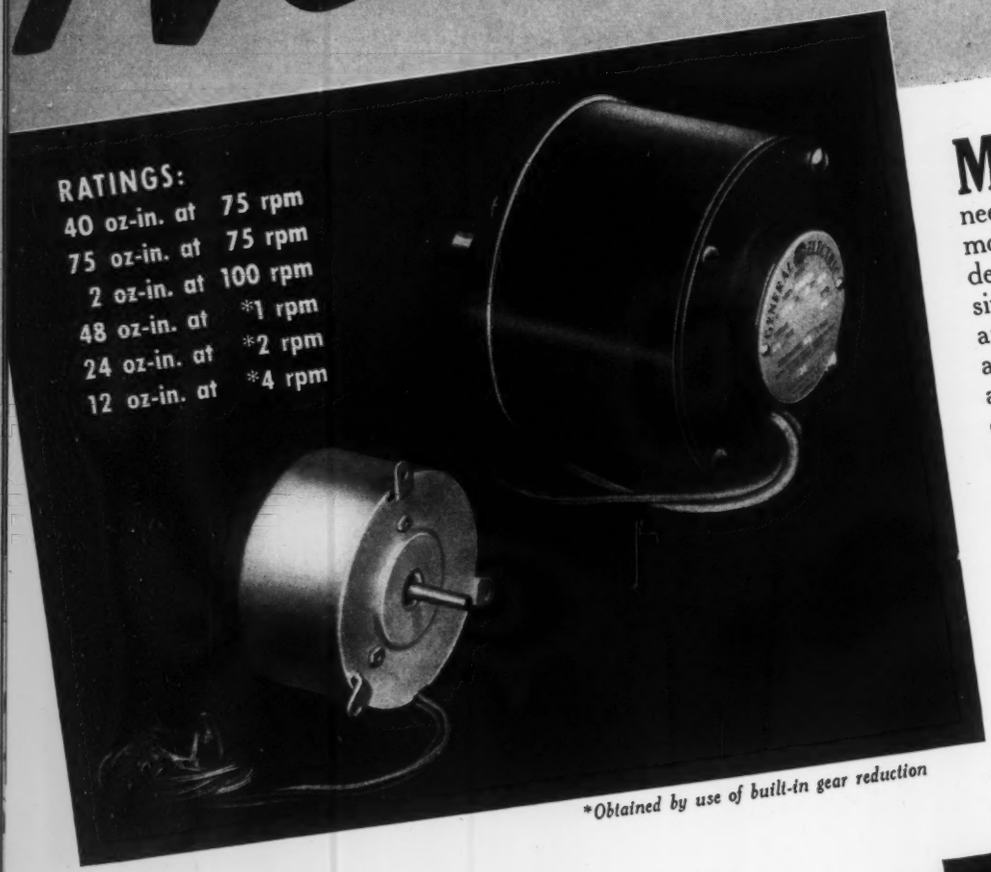
Firm.....

Address.....

080-176

GENERAL ELECTRIC

New SELF-STARTING SYNCHRONOUS MOTOR



*Obtained by use of built-in gear reduction

MR. Designer, here is a new low-speed motor that meets perfectly your needs for a self-starting synchronous-motor drive for instruments, large timing devices, remote-control equipments, and similar applications. It accelerates quickly and stops almost instantly. It is reversible, and its temperature rise is not appreciably affected by the rapidity of reversal. In case of accidental stalling, the motor will not be injured.

It operates quietly, has extremely long life, and the low current input makes the motor particularly adaptable to remote control. Your G-E salesman will be glad to explain this sensational new motor to you.

Any type of motor you need

General Electric has a complete line of standard motors for small devices like those listed at the right. Skillfully designed and carefully manufactured, these motors have ample output. They are available for round-frame, end-shield, or foot mounting, or without end shields for building into your product. You also have the choice of sleeve or ball bearings and open or closed end shields.

Get G-E engineering service

General Electric engineers will be glad to work with you on your motor applications and assist you in selecting the proper motor for your requirements. Contact the nearest G-E sales office or write to General Electric, Schenectady, N. Y.

For additional information

Write today for additional information on these motors. Ask for GEA-1844A on shaded-pole motors, GEA-3137 on hair-dryer motors, and GEA-1942A and GEA-1988A on small series motors.

Also a Complete Line of Small Motors for Devices like These

- Adding machines
- Advertising devices
- Bookkeeping machines
- Check protectors
- Control equipment
- Hair dryers
- Laboratory devices
- Motion-picture projectors
- Propeller fans
- Sewing machines
- Sirens
- Time recorders
- Typewriters
- Many others

GENERAL ELECTRIC

070-282

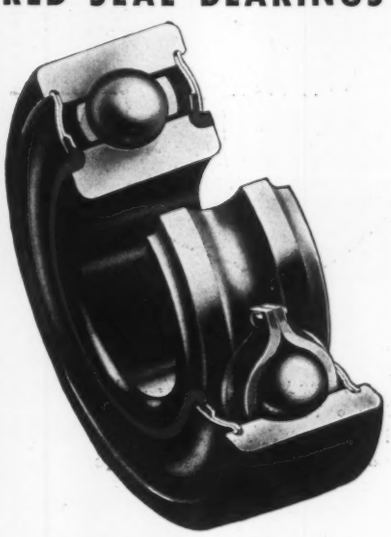
Again

SKF Responds TO INDUSTRY'S NEED!

New—A DOUBLE FELT SEAL BEARING MADE TO STANDARD SINGLE ROW WIDTHS

© 1939, SKF INDUSTRIES, INC.

SKF
RED SEAL BEARINGS



THE STOP SIGNAL FOR DIRT
Patent Applied For

1. Made to standard single row SAE dimensions with races flush on both sides.
2. Assures perfect sealing and retention of grease over great range of speeds.
3. Provides for large area of felt fibre contact, yet within the standard width.
4. Frictional drag is kept at a minimum, sealing by felt fibre contact on polished grooves instead of by compression.
5. Sealing ability is constant. Will not glaze. The resiliency of felt provides automatic correction for wear.
6. Provides the same lubricant space as in most off-standard bearings.
7. Simplifies design because of standard dimensions, saves space.

4388

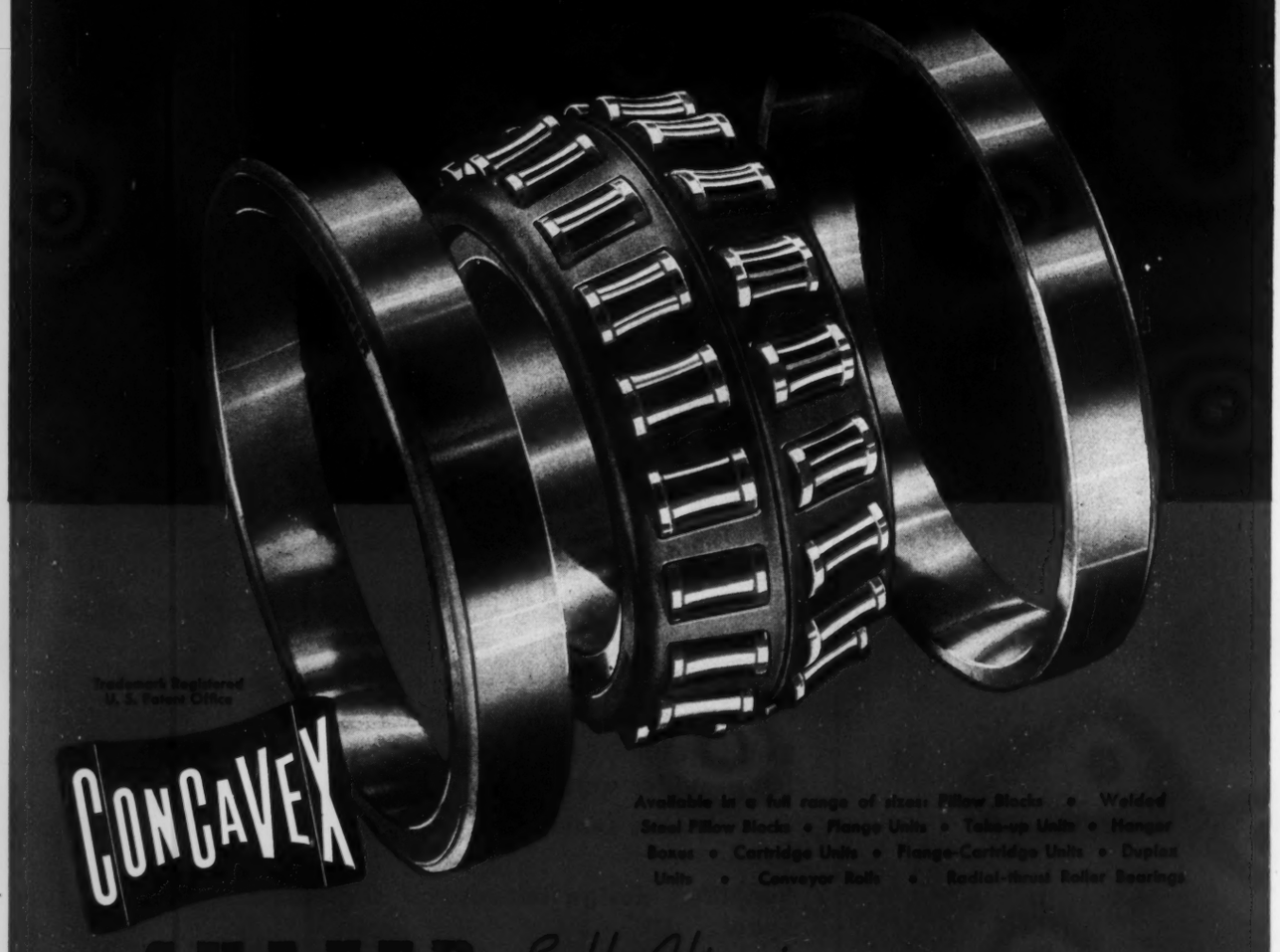
SKF RED SEAL BEARINGS

SKF INDUSTRIES, INC., FRONT STREET & ERIE AVE., PHILADELPHIA, PA.

Shafer concave roller design with matching convex races combines in a simple and efficient bearing assembly: 1. Rolling self-alignment as an inherent feature of the bearing itself; 2. Thrust capacity with loads distributed over the whole face of the bearing; 3. Provision for simple adjustability.

Only Shafer offers all these features in the same bearing—to insure long life and dependable bearing performance even under severe operating conditions.

SHAFER BEARING CORPORATION
35 EAST WACKER DRIVE • CHICAGO, ILLINOIS



Trademark Registered U. S. Patent Office

CONCAVEX

Available in a full range of sizes: Pillow Blocks • Welded Steel Pillow Blocks • Flange Units • Take-up Units • Hanger Boxes • Cartridge Units • Flange-Cartridge Units • Duplex Units • Conveyor Rolls • Radial-thrust Roller Bearings

SHAFER Self-Aligning ROLLER BEARINGS

THE finest—and the most convincing—test of value in any tracing paper is the *reputation* which it has established through years of use—under all kinds of conditions—in the drafting rooms of the nation.

There's a reputation like that behind every roll of Bruning Vellux . . . a reputation that's been accumulating user satisfaction since Bruning first introduced this vellum tracing paper in 1920. Thousands of draftsmen have found that Vellux has excellent transparency which it *keeps* through the years. Thousands have found that Bruning Vellux *stays* white . . . is free from light-retarding yellow tints. Thousands have discovered that Vellux has excellent erasing qualities . . . that it is durable and does not become brittle with age. Available in three weights, thin (350T), medium (350), and heavy (350H).

Bruning Vellux does not rest its case on mere claims—but on proved facts. Find out why Bruning Vellux passes *every* critical test of actual use—mail coupon now for a generous working sample. (Check weight desired.)

THIS COUPON WILL BRING YOU A FREE WORKING SAMPLE OF BRUNING VELLUX

BRUNING *Since 1897*

SPEEDS—SIMPLIFIES—AND PROTECTS A NATION'S DRAFTING

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Gentlemen: I want to try Bruning Vellux—the vellum tracing paper—*approved* by drafting rooms from coast to coast. Please send me, without obligation, a generous working sample. 350T ☐ 350 ☐ 350H ☐

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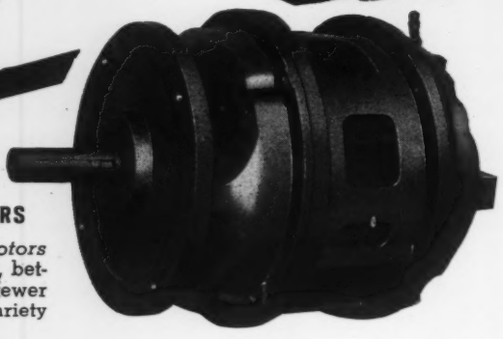
964- 62

SENSITIZED PAPERS, ENGINEERING, SURVEYING AND DRAFTING SUPPLIES AND EQUIPMENT

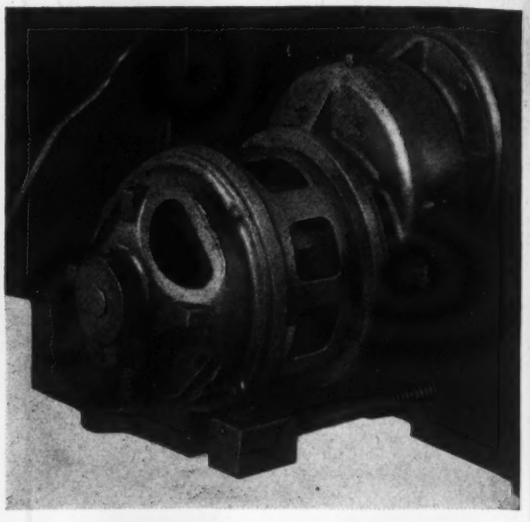
STEP UP QUALITY WITH "STOCK" DRIVES

Select the motors you need from standard Westinghouse designs — save the cost of specials — simplify your design problems — and build a better machine for less money.



FLANGE MOUNTED MOTORS

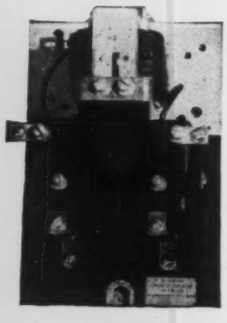
Save expense of special motors — and obtain a more compact, better looking machine — with fewer parts, by utilizing the wide variety of Westinghouse mountings.

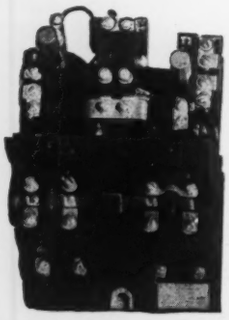


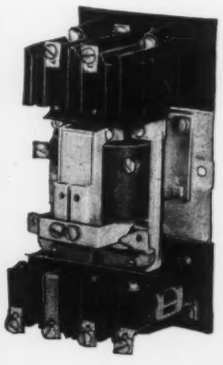
FLANGE MOUNTED GEARMOTORS

More efficient drives — with Westinghouse gearmotors, which provide exact horsepower needed, at required speed of driven machine. Save space, save parts, deliver 96% to 98% of high speed motor efficiency.

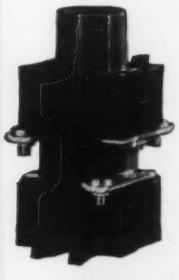
For protection to motors and circuits, select Westinghouse controls. Compact, easy to install, save maintenance and machine outage time.

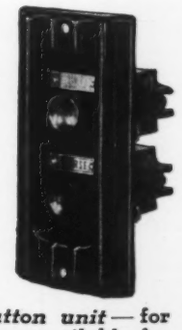






Across-the-line motor starters **and contactor units, for practically all built-in applications, with motor protection and all circuit interlocking functions.**

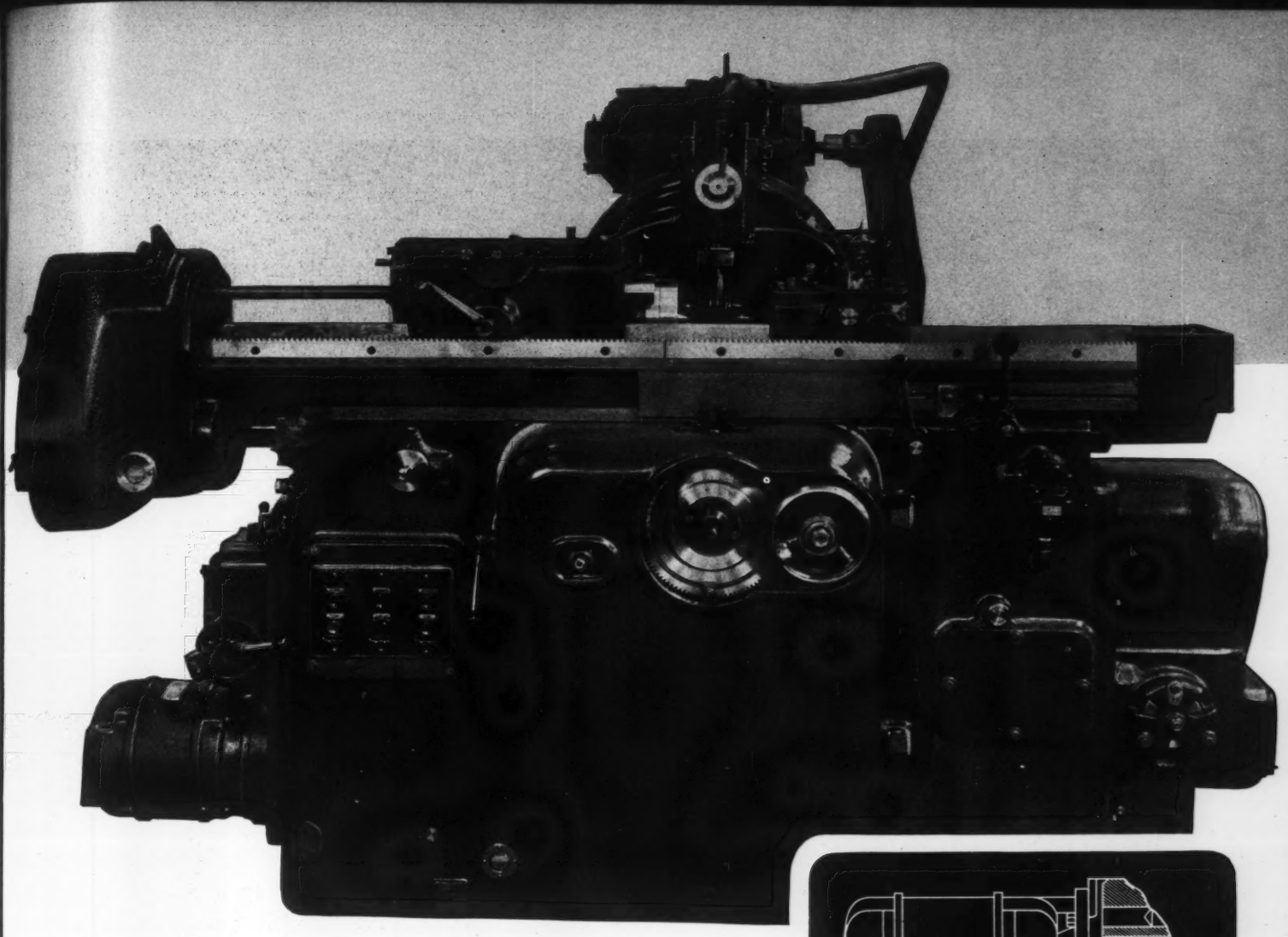




Standard push-button unit **— for built-in applications, available for steel plate, surface, and flush plate mounting.**

Westinghouse

W WESTINGHOUSE ELECTRIC

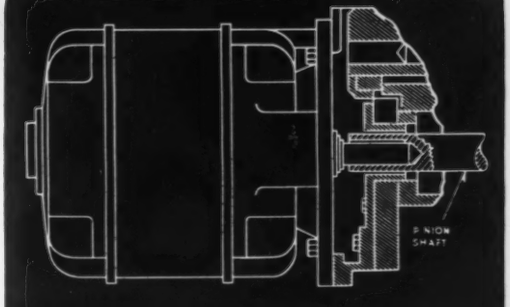


JONES & LAMSON DESIGNERS INCORPORATE LATEST WESTINGHOUSE MOTOR FEATURES IN NEW THREAD GRINDER

In designing their compact new 5" x 30" automatic thread grinding machine, Jones & Lamson Machine Company took advantage of the features available in standard Westinghouse motors.

The standardized, Type B, flange mounting of the direct connected work drive motor eliminates bedplate and coupling, and as indicated in the sketch (inset), the motor bearing actually serves as one bearing for the pinion shaft within the machine. The result is compact and economical construction which saves cost and improves appearance. Quality of work is improved by the use of dynamically balanced wheel drive motor. Westinghouse flush mounted push-button stations are grouped for the operator's convenience.

For redesigning or new developments on machine tools, investigate Westinghouse standardized motor parts. Your local Westinghouse representative will help you. There is a Westinghouse electrical wholesaler, industrial agent, or district office in all principal cities.



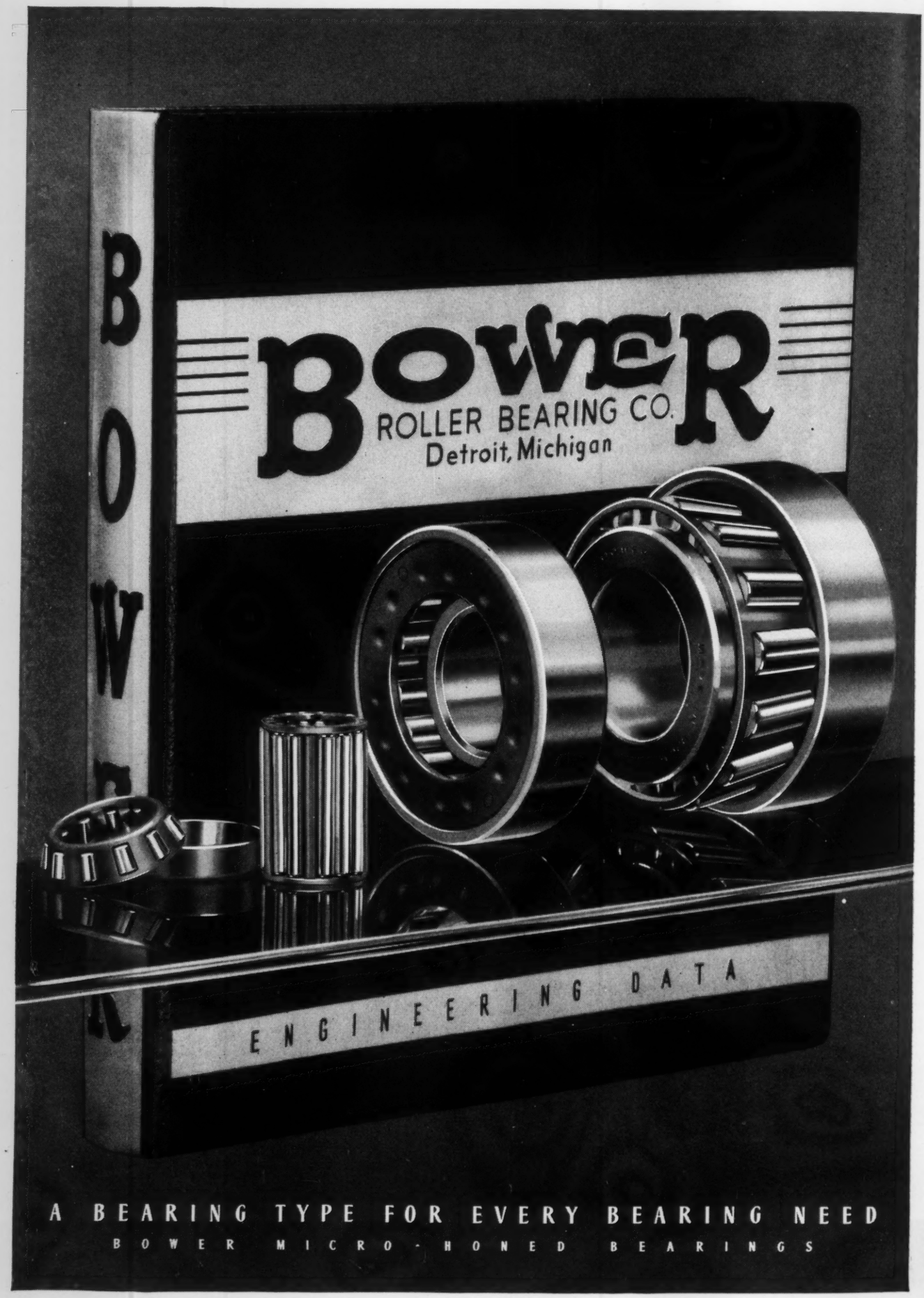
Standardized Westinghouse Drives on this machine include:

1—1½ hp flange mounted work drive motor
1—3 hp variable speed wheel drive motor
1—Coolant pump motor

J-90208

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Motors and Control


BOWER
BOWER
ROLLER BEARING CO.
Detroit, Michigan
ENGINEERING DATA
A BEARING TYPE FOR EVERY BEARING NEED
BOWER MICRO-HONED BEARINGS

Control Product Quality with SEMS*

REG. U. S. PAT. OFF.

FASTENING UNITS!

There's no question about tight connections when SEMS are specified for assembly operations. This pre-assembled fastening unit not only provides a screw already fitted with a Shakeproof Lock Washer, but the lock washer cannot come off in the assembly operation which means no screw can be applied without a powerful locking force to keep it tight. Of course, each type and size of screw is equipped with the correct size and type of lock washer to assure greatest locking efficiency. In addition to the control of product quality, SEMS offer many other important advantages such as: reduced labor costs, faster assembly, simplified stock control, easier ordering, balanced inventories, etc. Free testing samples are gladly furnished on request—write today!

* SEMS is the registered trade-mark of Illinois Tool Works, manufacturers of Shakeproof Lock Washers. Only genuine Shakeproof Lock Washers are used in the manufacture of SEMS.

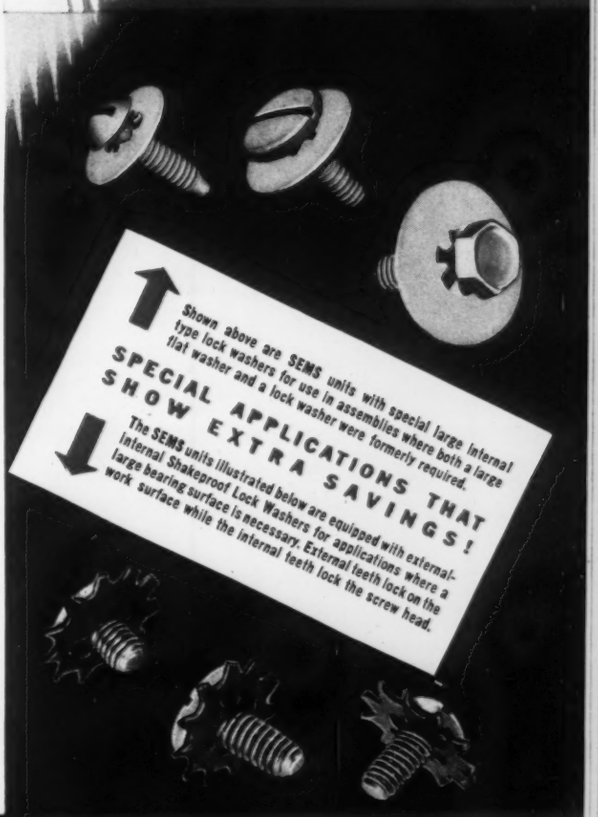
SHAKEPROOF LOCK WASHER CO.

Distributor of Shakeproof Products Manufactured by Illinois Tool Works

Plants at Chicago and Elgin, Illinois 2551 N. Keeler Ave., Chicago, Ill.

In Canada: Canada Illinois Tools Ltd., Toronto, Ontario

Copyright 1939 Illinois Tool Works



SPECIAL APPLICATIONS THAT SHOW EXTRA SAVINGS!

Shown above are SEMS units with special large internal type lock washers for use in assemblies where both a large flat washer and a lock washer were formerly required.

The SEMS units illustrated below are equipped with external-internal Shakeproof Lock Washers for applications where a large bearing surface is necessary. External teeth lock on the work surface while the internal teeth lock the screw head.

"Fastening SHAKEPROOF Headquarters"

Lock Washers . . . Thread-Cutting Screws . . . Self-Locking Set Screws . . . Locking and Plain Terminals . . . Spring Washers . . . Special Stampings

STATEMENT OF POLICY

The world is entering a crisis, the result of which no one can foresee. Other wars have brought inflation, followed by unemployment and depression after peace was achieved. America's experience in the World War illustrates this fact.

Much of this post-war trouble would have been eliminated by a more foresighted price policy on the part of manufacturers and distributors. Price inflation by the seller when he had a dominant position resulted inevitably in reaction with deflation, depression and suffering. Many of those price increases were not warranted.

Before such an inflationary cycle of prices is again started, we publicly pledge ourselves, as far as possible, to maintain present prices.

Further, if the materials we buy are increased in price, or the cost of labor is increased, then we pledge ourselves to raise selling prices no more than the bare increase in cost of raw materials and labor going into our products.

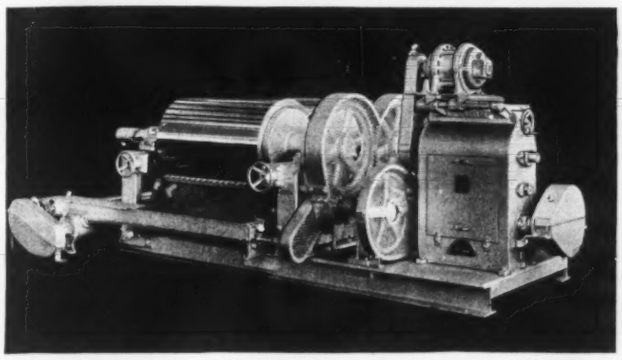
Further, we pledge ourselves to pass on to our customers the reduction in cost made possible by better manufacturing methods, wider distribution and technical advances in production.

THE LINCOLN ELECTRIC COMPANY

Cleveland, Ohio
October 2, 1939

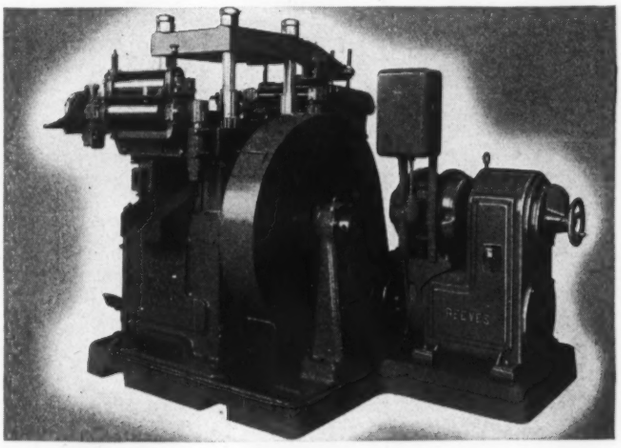
J. F. Lincoln
President

SPEED CONTROL APPLICATIONS THAT MAKE SALES *for Machine Builders . . .*



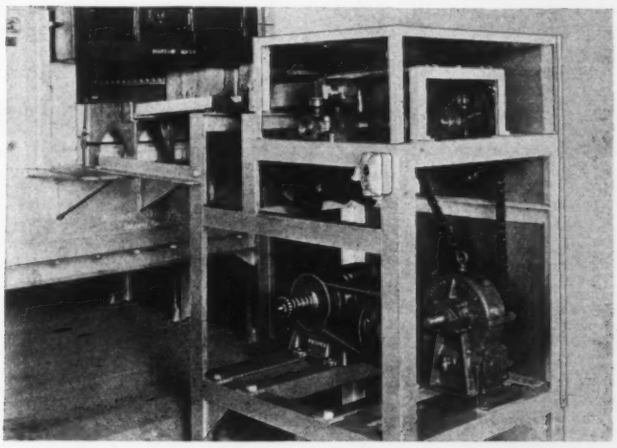
TRANSMISSION ON DRYER . . .

When a wide variety of materials and products can be processed *by one machine,* as on this drum dryer, the greater range of usefulness makes it a "better buy." Here, these results are accomplished by providing infinitely variable and accurate speed adjustability by means of the REEVES Variable Speed Transmission with which the machine is standardly equipped.



MOTODRIVE ON DIEING MACHINE . . .

Another example of the manner in which REEVES Speed Control can be incorporated in the design, to improve performance and sales possibilities of a machine. Size of dies, weight and kind of metal, etc., determine the speed at which this Dieing Machine should operate. REEVES Motodrive provides any speed required in a self-powered unit that is easily and quickly adjustable and thoroughly proved in accuracy and dependability.



MOTOR PULLEY ON HEAT TREATING FURNACE . . .

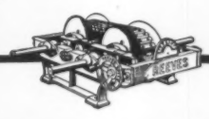
Loading mechanism end of this electric continuous pusher type heat treating furnace is controlled by a REEVES Vari-Speed Motor Pulley to permit changes in heating time for different types and sizes of metal parts.

●

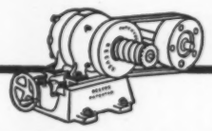
Builders of 1328 different industrial machines realize that variable speed control may be an asset, or a liability to sales, depending upon its cost, efficiency of operation and freedom from annoying repairs and servicing. Only REEVES Speed Control has the record of performance to warrant the inclusion of these units as standard equipment on their machines. Catalog G-397 illustrates and describes many of these units. Ask for your copy.

REEVES PULLEY COMPANY, *Dept. H,* **COLUMBUS, INDIANA**

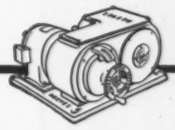
Reeves **SPEED CONTROL**



REEVES VARIABLE SPEED TRANSMISSION— Provides infinite speed adjustability over wide range and for heavy duty service. Accurate and positive at all speeds. Modern open and enclosed designs, vertical, horizontal. Fourteen sizes—fractional to 75 h.p. Speed variations 2:1 to 16:1 inclusive.



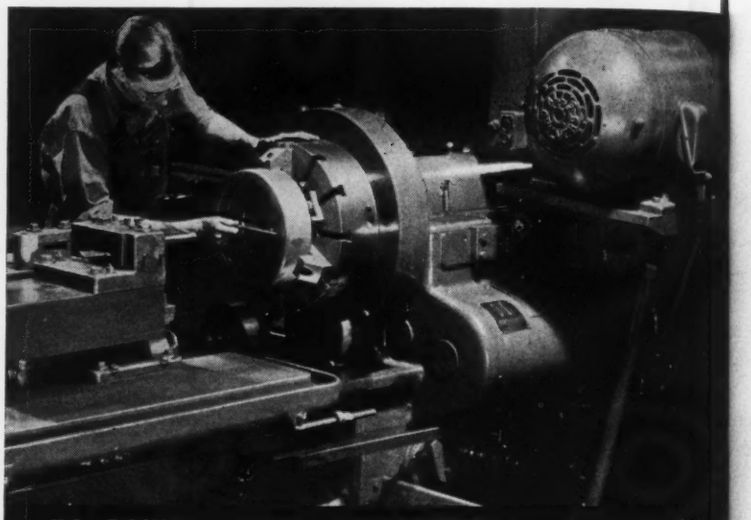
REEVES VARI-SPEED MOTOR PULLEY— Simplified development of Transmission. Mounts on standard shaft of any constant speed motor. Forms direct drive to machine. For light horse power requirements up to and including 15 h.p. and not greater than 3:1 ratio of speed range.



REEVES VARI-SPEED MOTODRIVE— Combines in one compact, self-contained enclosure, constant speed motor, REEVES speed varying mechanism and reduction gears (where required). In space-saving horizontal and vertical types—¼ to 10 h.p. Speed variations 2:1 to 6:1 inclusive.

BUILD EXTRA SALES VALUE INTO YOUR MACHINES!

Get the Facts on How Allis-Chalmers Lo-Maintenance Motors Help Protect Your Reputation ... Actually Maintain the High Standards of Production Your Customers Demand in the Motors that Power Your Machines!



TO POWER THEIR EQUIPMENT, manufacturers of modern machines are wisely selecting Allis-Chalmers motors, such as the 15 hp Type "ARZ" Lo-Maintenance motor shown here . . . thus giving their equipment "Extra Sales Value!"

No matter how good a machine tool is . . . no matter how efficiently it operates . . . it's only as good as the motor that powers it! That's why manufacturers are switching to Allis-Chalmers Lo-Maintenance Motors! They know they get a motor that upholds the reputation of their own machine!

But they get more! And you'll get more, too. You get a motor that's fast winning the acceptance of users of your machines in every industry . . . because the full measure protection built into every Allis-Chalmers Lo-Maintenance Motor makes them stand up for years under conditions that many times wreck ordinary motors in a few weeks.

When you buy a Lo-Maintenance Motor, you get more than a motor that delivers just a certain rated horsepower. You get a motor that has built into it Allis-Chalmers 90 years of advancing with industry . . . of making motors to meet the rigid requirements of their own famous line of heavy duty industrial equipment!

High carbon steel frame . . . indestructible rotor and stator . . . husky all-around construction with no skimping on material . . . add them together and you get a motor that's built for long life . . . without running up costly repair bills!

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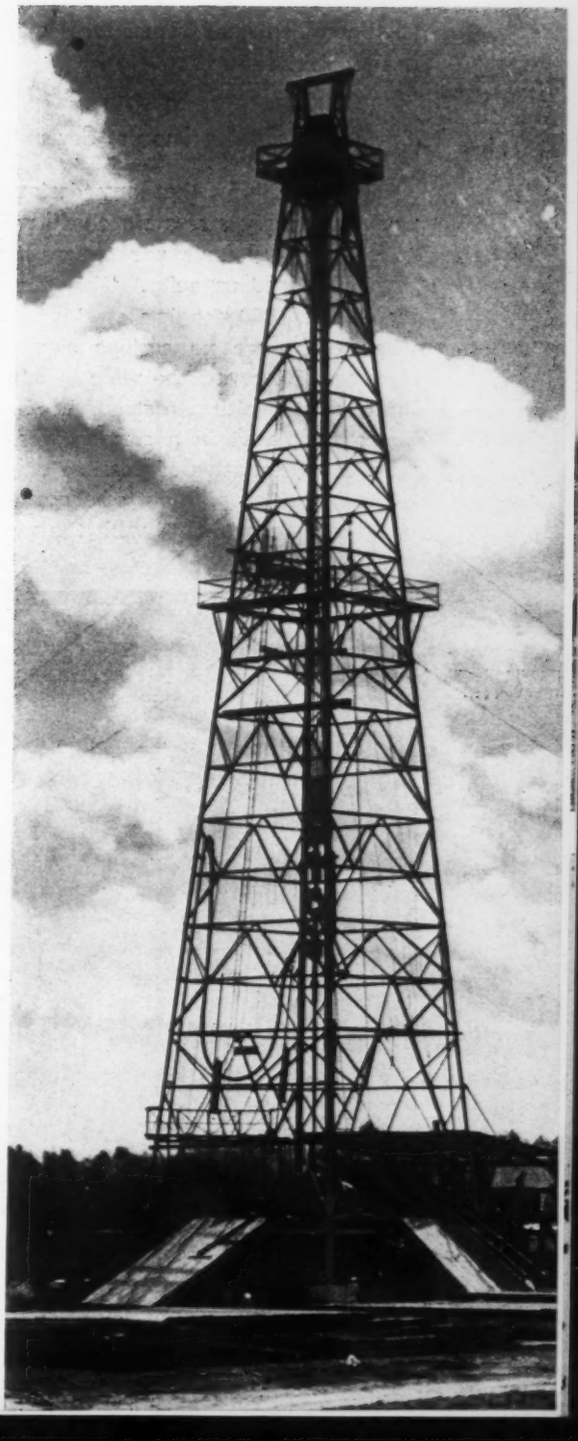
MACHINE DESIGN

MATERIALS in Oil Field Equipment

By H. F. Shepherd



OIL field machinery furnishes one of the best examples for the selection of materials from the standpoint of durability in service. For example, pumpage from wells varies from nearly all oil to nearly all water often intermixed with dissolved salts, hydrogen sulphide, natural gas and various sands and earths. All parts which come in contact with this pumpage must therefore withstand severe abrasion and corrosion service. The haste encountered in drilling causes all parts of the equipment to be highly stressed and is typical of the high endurance materials required for this service.

Structural shapes and plates fabricated by welding are used for engine transmission skid bases and draw works frames. Frame deflections are harmless to machinery because self-aligning bearings and flexible couplings are utilized. If more than two bearings are required in a line couplings are interposed.

In areas where difficult terrain or bad roads are encountered light frames made of low weight, low alloy steels are being utilized. They are of good welding quality when approved rods and technique are used. Where very light portable rigs are required the high elastic limit of the low alloy steels, 45,000 to 60,000 pounds per square inch is a comforting reserve for the designer's use.

In most areas an uncased hole presents some serious hazards.

If rotation and circulation cease, the walls may cave and seize the drill pipe. To some extent duplicate auxiliaries are at hand but 100 per cent availability of the hoisting and rotating machinery is essential. For this reason all housings, too complicated for economical fabrication from plate are of cast steel. The alloy grades of .35 to .45 carbon prevail (as S.A.E. 3135-3145). The high elastic limit and consequent resilience of these materials is invaluable against accidental shocks by the dropping of a block, a swivel or stand of drill pipe or a fall due to the breakage of a truck winch line during loading or unloading operations.

All bearing or pillow block housings, swivel bodies and cast block fittings are of steel. Housings for speed change gear boxes transmitting more than 150 horsepower are of electric furnace alloy steel. Electric generators and motors utilized have either cast steel or rolled steel frames fabricated by the arc welding process.

Drilling Imposes Severe Loads

It is not likely that any designer of heavy rigs would wittingly stress rig shafting more than 20 or 25 thousand pounds per square inch at the rated maximum load capacity. This stress is safely borne by S.A.E. 1050 forging steel properly heat treated when there are no serious superimposed vibration stresses. However, the wide gap between the elastic limit and the ultimate strength of such steels cannot be contemplated in a service where a driller faced with the alternative of possible damage to the rig or of fishing stuck pipe out of thousands of feet of hole decides to "rare on it" with the whole momentum of the moving power units against a stalled load. S.A.E. 3145, 4640, 4140 and 6145, forged, air quenched and drawn show remarkable resilience in this service replacing the ordinary grades of machinery steel which never were satisfactory. A rotary rig with its power plant is shown in *Fig.* 3 and design of a typical rotary table is illustrated in *Fig.* 2.

Mud Is Abrasive

S.A.E. 3145 and kindred cast materials find universal application in drilling machinery because they are adaptable to many uses. These materials flame harden when required as for heavy sprocket teeth. Heat treated so as to remain machineable they still have excellent resistance to surface impact and abrasion since they work harden without tending to spall. Hadfield type manganese steel castings are also used for sheaves and kelly drive bushings where conditions are severe. Unfortunately they can be machined only by grinding.

Drilling mud properly treated and handled acquires a creamy texture but it is aerated and slightly corrosive and more abrasive as is shown where high pressure leaks cut away material at an astonishing rate. A sectional drawing of a typical mud pump is shown in Fig. 1.

Pump liners and wash pipes for swivels are made of centrifugally cast alloy iron, of borium fused to steel tubes and of various case hardening materials. For general use S. A. E. 4615 which may be carburized and hardened to 600 Brinell has given excellent results against abrasion and corrosion. The same material is used for piston rods with S.A.E. 4815 as an alternate. Piston packings are usually rubber

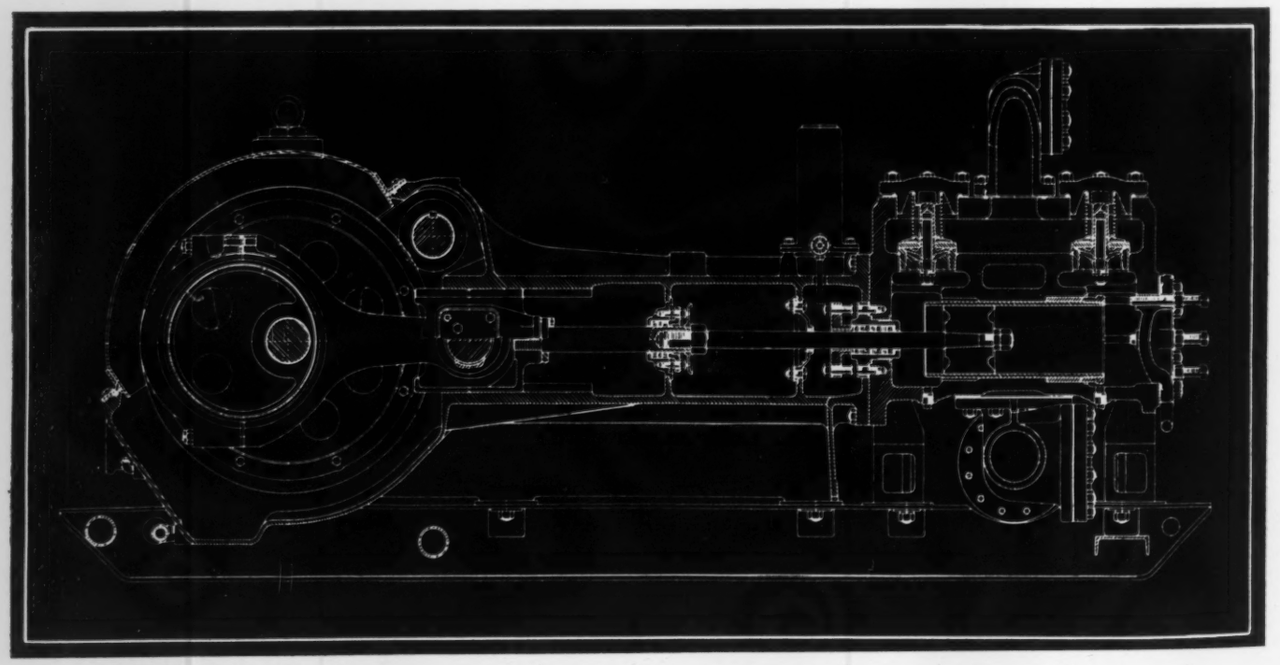


Fig. 1—Sectional drawing of a mud pump showing crank, connecting rod, piston and valves

Fig. 2—Right—Drawing of rotary table. Design of bearings ring gear and pinion are shown

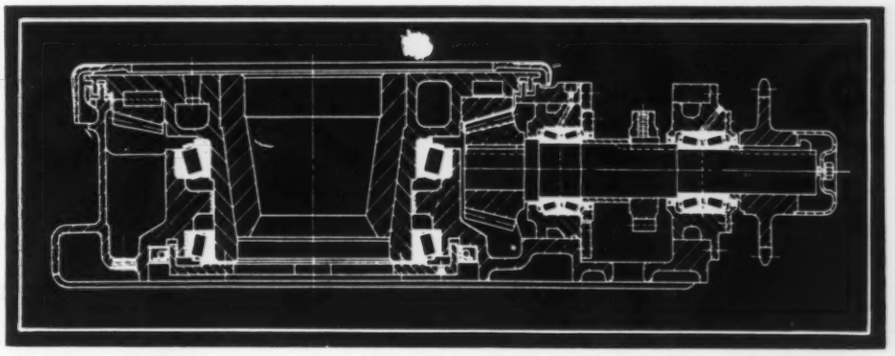
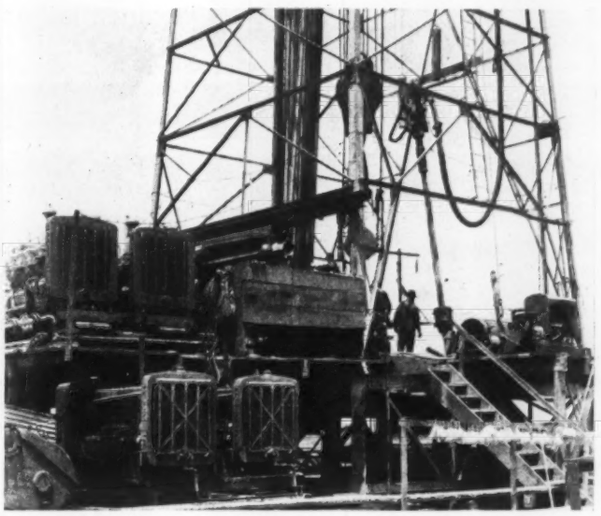


Fig. 3—Below—Rotary rig with diesels driving draw works, rotary table and mud pumps



formed to be expansible within narrow limits under the working pressure.

Conventional rock bits are now used for almost all kinds of digging. Mud is the only lubricant and thrust loads are severe. A bit lasts about twenty-four hours. The teeth are hard faced on one side, the other side being carburized and quenched. This differential in hardness causes the teeth to wear sharp. The welding rod used for hard facing is usually a soft steel tube filled with boron particles and flux. Some cutters are fitted with hard faced inner and outer races. The materials used are usually regarded as proprietary but it is generally believed that where S.A.E. 4815 is not considered adequate for rollers and balls S. A. E. 2515 or the Krupp high nickel chromium case hardening steel is often the final answer to the problem.

Alloys Extend Shaft Life

Cable or percussion tools are used where hard rock starts at the grass roots. In this case the rotary drill stem does not have sufficient length to give it the weight necessary for digging. Cable tools also are used for completing rotary drilled wells to avoid mudding off the producing sand with its resultant troubles.

The spudder, descendant of the artesian well drilling machine is now undergoing a renaissance. Materials are the same as those used in rotary machines and it is reported by one manufacturer that the substitution of alloy forging steel for common machine steel extended the life of shafts from four or five months to three or more years under severe drilling conditions.

Sucker Rods Resist Corrosion

When wells cease to produce naturally they must be pumped. The most generally used equipment comprises a reduction gear box with crankshaft and pitman driving a walking beam which oscillates the sucker through as many thousands of feet of sucker rod as may be required. The most difficult problems are encountered with the equipment that is used beneath the surface.

At one time the nature of the rod load and the conditions limiting its fatigue of life were so little understood that many wells were shut down for repairs one day in the week. This necessitated hoisting out rods or rods and tubing and the loss of production was considered as unrecoverable. Profitable operation was consequently more difficult.

The elastic movements of the rods have been investigated scientifically and rod materials have been adequately tested for corrosion fatigue in oil, salt water and hydrogensulphide solutions. Nickel moly steel with nickel increased from 1.50/2.00 per cent to 3.25/3.75 per cent does excellent work under corrosive conditions. Sucker rods are one of the most carefully inspected steel mill products and elaborate plants had to be devised for their heat treatment to reach today's quality. For the case hardened coupling, S.A.E. 4615 and 4620 are two of the more popular materials.

Pump liners are gray iron, alloy cast iron, centrifugally cast alloy iron or graphitic steel. A free graphitic content is stressed by almost all makers. Pump valves are usually of the ball type. Hardened or case hardened carbon steel is satisfactory only in sweet crudes. Bronzes are used with some success against corrosion but unfortunately cannot be hardened to resist sand. Monel *K* has made new and unusually good records in applications to this type of service.

Scanning the Field For Ideas

Makes Easy Clutching

APPLYING the principle of overcenter springs, Chrysler corporation engineers have materially reduced the effort required for clutch operation by use of an assister spring as illustrated in *Fig.* 1. When the clutch pedal is depressed about one inch, this heavy spring moves over center and by its tension

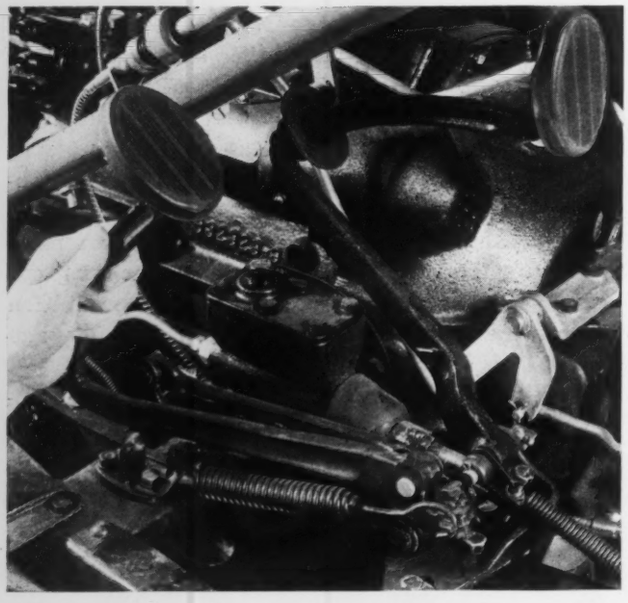


Fig. 1—Strong overcenter clutch assistor spring assists operator in clutching after an initial effort

aids the driver's foot during the remainder of the declutching operation.

Another interesting feature of the clutch is air cooling to dissipate the heat produced by friction of the clutch disk. Air is forced throughout the entire mechanism by ribs on the main pressure plate which cause a fan action when rotating. Drawn through a screened opening in the side of the clutch housing, the air is circulated through holes in the clutch cover and finally expelled at screen, and vents in the upper side of the housing. With this constant flow of air around the mechanism and through the perforations in the two contacting surfaces, the temperature is so regulated that the clutch will continue to function with full efficiency.

Die Casting Provides Compactness

UTILIZING a disk of Alnico (an alloy containing nickel, aluminum, cobalt and iron), a small, lightweight magneto has been designed which is capable of relatively high electrical output. Designed as a lighting generator for bicycles by the E. A. Laboratories, Inc., Brooklyn, N. Y., this device is illustrated in *Fig.* 2. Any speed above two miles an hour will generate sufficient current to light the lamp. A rheostat controls the output between 3 and 8 watts at 6 volts.

The field portion of the magnetic circuit is the Alnico disk, ground flat on one side, and four soft rolled steel pole pieces. These parts together with a steel supporting stud and a bronze bushing for the armature shaft are all die cast into a one-piece housing. High coercive force, low residual induction as well as being unaffected by vibration make the magnetic material particularly suitable for this application. Not being affected by high temperatures the die casting

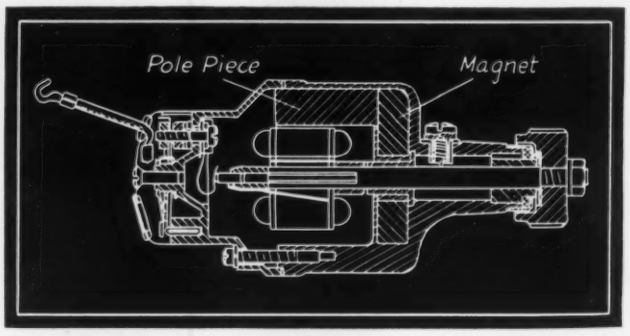


Fig. 2—Diagram of magneto showing field parts in die cast housing. Pole piece is soft rolled steel

(*Concluded on Page* 54)

Combination of Properties Is Strong Point of Malleable Castings

By C. T. Eakin
Westinghouse Electric & Mfg. Co.

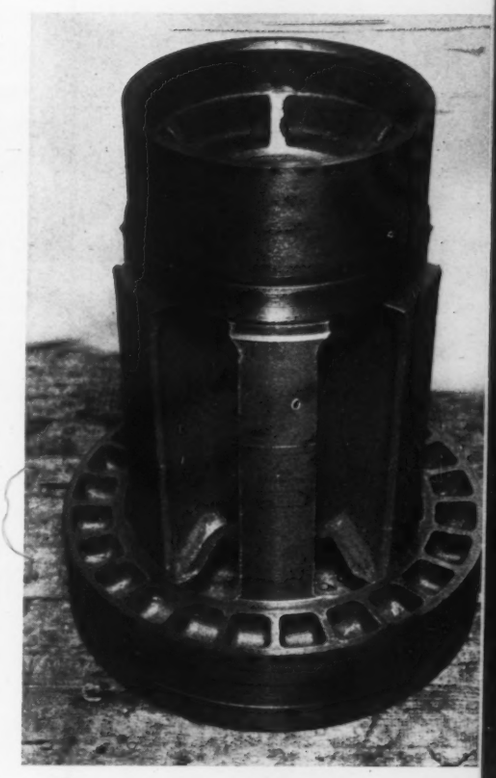
DESIGNERS as a rule are not fully aware of the possibilities of the high grade malleable iron being produced today. Although similar in appearance to cast iron, its general properties and applications are distinctly different. Cast iron in the as-cast condition ordinarily contains from 2 to 3½ per cent carbon, part of which is present in the form of iron carbide and the balance as graphite. The latter exists more or less as tiny flakes or saucer-shaped particles which contribute to softness and machinability but have virtually no strength. *Fig.* 1 shows normal cast iron at 100 diameters, polished but not etched. The short and more or less curved lines represent cross sections of graphite flakes.

Malleable iron as cast contains 2 to 3 per cent carbon present in the combined form. To obtain a soft and ductile material the castings are given a suitable heat treatment to decompose the hard carbides, leaving substantially all the carbon in the form of free temper carbon nodules. In *Fig.* 3, a section of malleable iron at 100 diameters, polished but not etched, the large black spots represent these nodules of temper carbon.

The matrix of the annealed casting which is responsible for the strength and ductility of the material is a form of iron having alloyed with it approximately one per cent silicon and small percentages of manganese, phosphorus and sulphur. The graphite, or free temper carbon, nodules in malleable iron interrupt the continuity of the matrix only to a slight extent.

In *Fig.* 3 it may be observed that the edge of the photomicrograph is almost free from nodules representing temper carbon. This condition is the result of surface decarburization during the annealing process, and can be controlled by proper furnace atmospheres. Normally there is some decarburization as shown but the effect of this is not a considerable factor.

The American Society for Testing Material (ASTM A47-33) specifies that malleable iron castings be made by the air-furnace, open hearth, or electric furnace process and that the castings be free from primary graphite. Two grades are covered and a third is in the tentative form. The tensile values



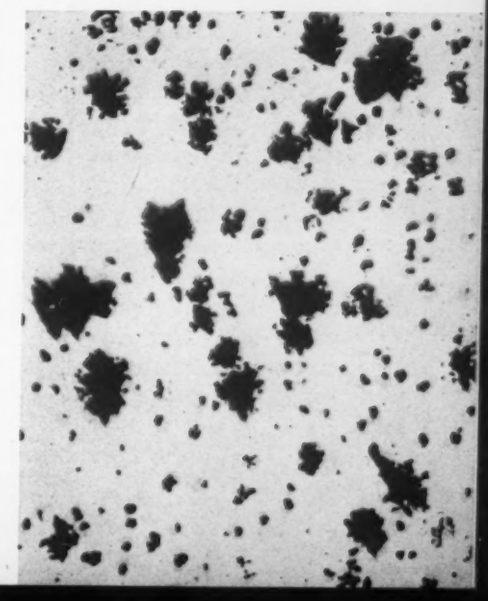


Fig. 1 — Top — Tiny flakes or saucer-shaped particles in cast iron contribute to machinability but have little strength. Magnified 100X. Fig. 2—Center—Malleable iron finds wide use in castings weighing less than 15 pounds, but is also employed successfully in large castings like this 360-pound motor spider. Fig. 3—Right—Large black spots in malleable iron represent nodules of free temper carbon, left after heat treatment. Magnified 100X

for cast test specimens are listed in Table I.

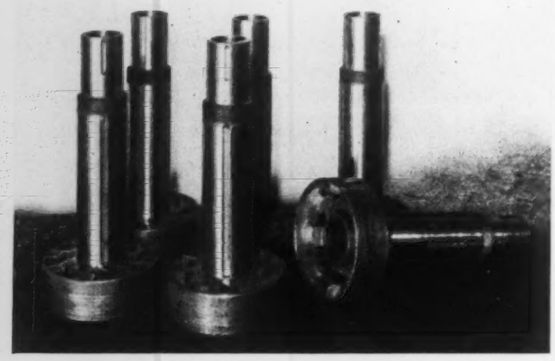
TABLE I

Physical Properties of Malleable Iron (Minimum)*

	ASTM Grade 32510	A-47-33 Grade 35018	A-197-36T (Tentative) Cupola grade
Tensile strength (lbs./sq. in.)	50,000	53,000	40,000
Yield point	32,500	35,000	30,000
Elongation (pct. in 2 in.)	10.0	18.0	5

**ASTM Standard cast tension test bars.*

It may be observed that the strength-ductility relationship in malleable iron differs somewhat from that in mild steel. In the latter we are accustomed to expect a decrease in elongation to accompany an increase of tensile strength and yield point, but in normal malleable iron this relationship is reversed.



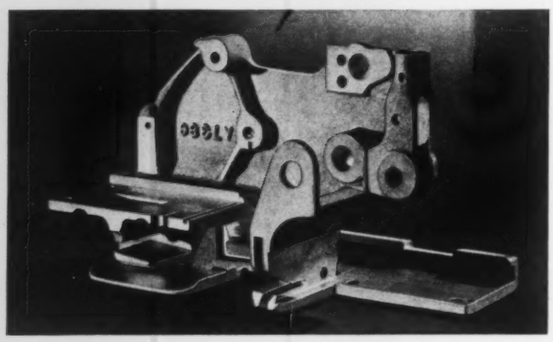


Fig. 4—Good machinability was chiefly responsible for choice of malleable iron for this armature spider. The casting is also unlikely to seize when pressed on shaft. Fig. 5—Below—Fifty-nine separate machining operations were performed on this intricate casting. Photo courtesy Acme Steel Co.

With respect to strength, yield point is frequently the deciding factor in selection of a metal for a given part. The yield point of malleable iron usually falls between 65 and 75 per cent of the tensile strength, a ratio somewhat higher than for soft steel which is approximately 50 per cent of the tensile strength.

Table II has been prepared to illustrate on the basis of a yield point of 34,000 pounds per square inch, the comparative properties of malleable iron, cast iron, cast steel and steel forgings.

Size often determines whether a metal is adaptable to the part to be made. While malleable iron is used successfully in castings weighing several hundred pounds, as for instance the motor spider shown in *Fig.* 2 weighing 360 pounds, it finds wide use in castings weighing less than 15 pounds. In the hands of an expert malleable foundryman, castings exceedingly small may be produced.

Cost of malleable iron castings is a difficult matter to evaluate because of the many factors by which it is affected. Of the metals listed in Table II the cost per pound of malleable would ordinarily be less than for either cast steel or forgings but more than for cast iron. By taking advantage of the superior strength, ductility, and shock resistance of malleable, however, it is frequently practical to reduce the section to the extent that the saving in weight will balance the difference in price per pound.

Frequently the selection of a material hinges upon the amount and kind of machining operations to be performed. Malleable iron ranks as one of the most easily machined of the ferrous metals. The armature spiders shown in *Fig.* 4 are examples of the choice of malleable iron chiefly because of its good machinability. Another advantage of malleable iron for this application is that it is much less likely to "seize" when being pressed onto the shaft than if the casting were made of cast or forged steel.

An extremely intricate and complicated casting, on which 59 separate machining operations are performed is shown in *Fig.* 5. Casting was the only feasible process for production, and malleable was selected for various reasons.

Material Must Be Rigid

Casting finish allowance on this part is 1/16-inch, with the exception of the base plate, ⅛-inch. In numerous cases, distances between center lines of holes are held to machined tolerances of .002-inch in two or more directions. Moreover, because of the large number of machining operations the material in the part had to be sufficiently rigid to hold the elements of the machine in close alignment. The 25,000,000 pounds per square inch modulus of elasticity of malleable iron proved ample.

Fig. 6 is a casting of an inner mower shoe on a reaper, which formerly required milling operations on faces *A, B, C* and *D*. By a special die arrangement the castings are pressed and coined in one operation at the foundry and thus machining is eliminated. In the rough casting, dimensions from *A* to *B, B* to *C,* and *C* to *D* are all held to a tolerance of .008-inch.

Pearlitic malleable iron is a notable example of the progress made by the industry during the last two decades. This product is higher in strength and somewhat less ductile than normal malleable iron. The change in tensile properties is brought about by so manipulating the practice that a certain amount of

TABLE II

Some Comparative Properties of Four Ferrous Metals on the Basis of the Same Yield Point

Material	Yield Point	Tensile Strength	Elongation pct. in 2 in.	Izod Impact	Machinability	Remarks
Malleable Iron..	34,000	53,000	18	16	Excellent	May be cast into thin and intricate shapes close to finish dimensions; machines well regardless of thickness of section; will withstand severe distortion without rupture.
Cast Iron	34,000	34,000	Too low to measure	Too low to measure	Excellent	May be cast into thin and intricate sections close to finish dimensions. Machinability varies with thickness of section. In castings with light and heavy sections, light sections are apt to be difficult to machine.
Cast Steel	34,000	65,000	26	30*	Fair to poor	Not adaptable to sections thinner than ⅜-inch. Must be properly annealed to insure this combination of properties. Machines fairly well on the lathe but "draggy" on automatic screw machine.
Forged Steel	34,000	65,000	30	70*	Fair to poor	Limited to rather simple shapes. Machines fairly well on lathe, tough and "draggy" on automatic screw machine. Must be properly heat treated to insure combination of properties. Quantity must be large because of cost of dies.

*Variable, depending upon sectional thickness, location and direction, heat treatment, etc.

the carbon will be present as iron carbide in the form of martensite, troostite, sorbite, pearlite, or a spheroidized pearlite, each of which affects the physical properties of the product after the manner in which it influences steel. The prevailing applications for this type of malleable require a pearlitic structure and for this reason the term "pearlitic malleable" seems most descriptive for this material.

Carbon Varies Tensile Strength

By varying the amount or the microstructure of the combined carbon, the tensile strength may be made to vary from that of normal malleable iron to approximately 120,000 pounds per square inch, the elongation falling proportionately to perhaps one per cent or even less. Pearlitic malleable with approximately 70,000 pounds per square inch ultimate strength and 10 per cent elongation may be produced for use where resistance to wear or abrasion is a controlling factor. Careful manipulation of the heat treatment, with or without the introduction of alloys such as manganese, copper, molybdenum, etc., permits a wide range in microstructure and in physical properties.

The data in Table I represent what may be expected of sound malleable. The casting must be free from defects such as gas pockets, pin holes, sand inclusions, cold-shuts, shrinkage cavities, hot tears, and cracks. The first four defects listed are detrimental chiefly because they reduce the effective metal section. The last three (shrinkage) defects not only cut down the effective section but also are likely to be located in the fillets where the service stresses usually are high. They serve as stress raisers and from them, under conditions of severe stress or vibratory service, may be propagated cracks which would cause failure.

The first castings made to a new design or by a new supplier should be tested carefully to determine if internal defects are present so that if found an appropriate remedy can be applied in making subsequent castings. In making a new design the following rules should be carefully observed:

1. Keep the sections as nearly uniform as possible
2. Avoid sharp edges
3. Make fillets generous
4. If it is necessary to join thick and thin sections, taper the latter gradually to the former

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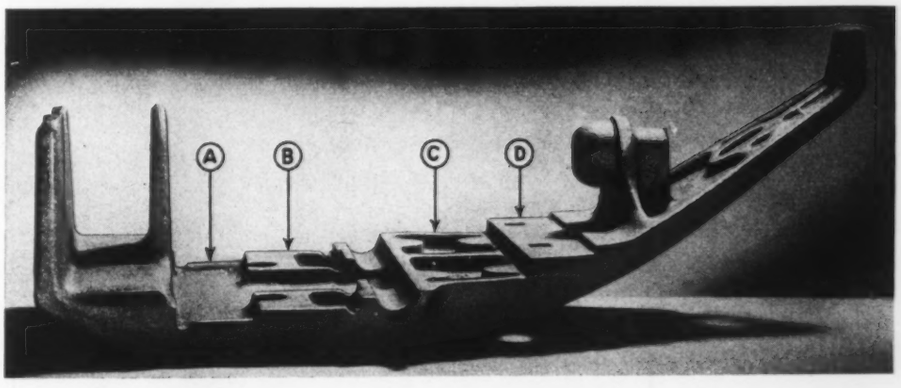
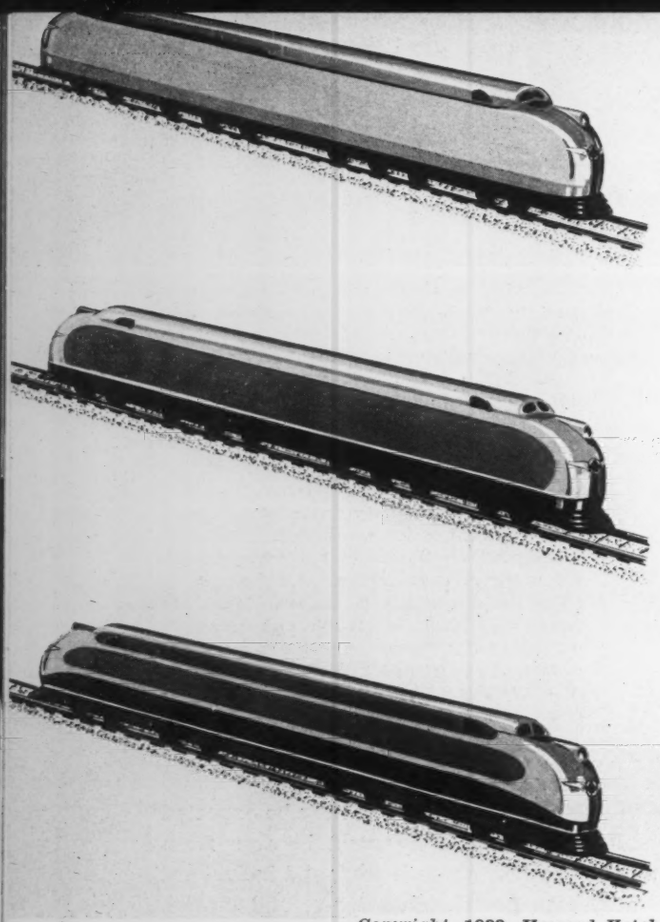


Fig. 6—Milling operations were formerly necessary on faces A, B, C, and D on this inner mower shoe on a reaper, but this machining has been eliminated at the foundry. Photo courtesy New Idea Inc.



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How color layout affects appearance is demonstrated by three treatments of a locomotive. Effect at top is massive but lacks distinctiveness. At center, by ending "length band" and rounding it at ends, feeling of speed and size is enhanced. Parallel bands of the same color, indicated at bottom, increase length and speed, giving a stable, underslung appearance in keeping with modern trends

Color Styling

By Howard Ketcham
President, Howard Ketcham, Inc.

NO DISTRACTING or disturbing influences should be permitted in planning a color layout for a machine. Simplicity of arrangement does much to provide dramatic emphasis. Less than one-fourth of the manufacturers of machines in this country, however, appreciate sufficiently the opportunities correct colors afford in building new acceptance and added prestige.

For example: Two identical injection molding presses were supplied to a user. One had the usual shop coat of paint while the other was finished in colors to facilitate its operation and enhance its appearance. Controls received identifying colors, pedestals were painted in light-reflecting hues, working areas were colored to assure fullest possible visibility. Two years later, during an inventory, the regularly finished machine was given the usual depreciation rating while the other was valued at $500 more than its less colorful companion. Operators had taken extra pride in its appearance. They took better care of its maintenance and working parts. Output superiority made it more valuable.

Right colors in the right places are not only esthetically appealing but practical when applied to certain types of machinery. Some manufacturers take advantage of the relatively inexpensive expedient of using correct colors to secure a degree of improvement in appearance that was formerly held possible only by costly die changes for the newer models.

It is not contended that factors such as mechanical precision and the intrinsic engineering merit of any machine can be overlooked simply by correctly coloring various parts in relation to each other and the surroundings. It *is* maintained, however, that the use of color can produce the instantaneous appeal which increases sales volume. Furthermore, customer satisfaction and good will can be enhanced immeasurably.

Factors Affecting Selection

Factors of importance for primary consideration in determining color selection for machinery in general include: (a) Colors that provide adequate light reflection, particularly where moving parts need constant, concentrated attention; (b) colors that are

WIDELY known as a color and design consultant for companies such as General Electric and E. I. du Pont de Nemours, Howard Ketcham has contributed to the color styling and design treatment of many machines including agricultural, coin-operated, dairy, confectionery and domestic. His color selections have been used by almost every American manufacturer of automobiles, and credited to him also are the interiors for the Pan-American Clippers, Stratosphere Liner and new Douglas DC-4's

...Helps Sales!

fresh, stimulating and appropriate to their surroundings and use.

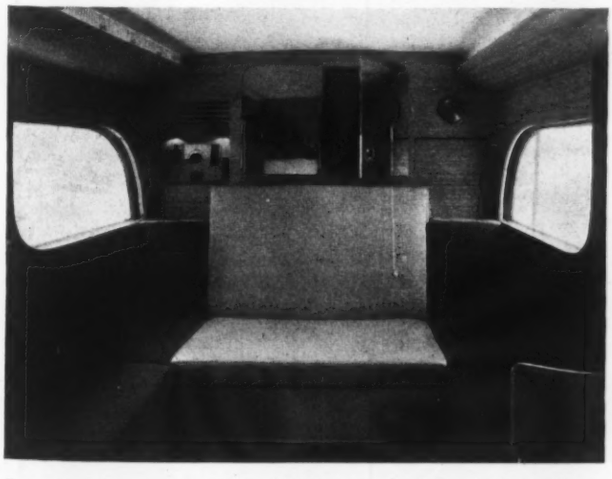
Each article in a factory or plant possesses a reflection factor different from all others. Consequently, each influences the visibility of its neighbors. Some colors absorb light while others reflect it. The latter, therefore, are more visible. It is essential to provide colors contributing to the visibility of every part of a machine which must be observed during operation. Thus control of the device is simplified, errors reduced, and fewer interruptions occur. Table I illustrates the reflection values of hues selected for their adaptability to machinery.*

TABLE I

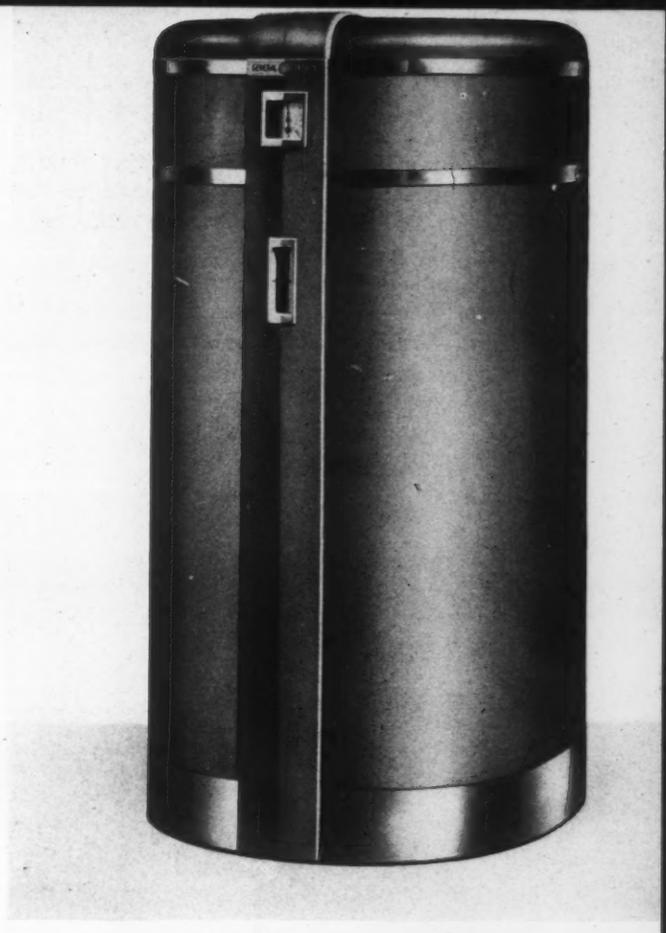
Light-Reflection Values

Color	Per Cent Reflection	Color	Per Cent Reflection
White	89	Aluminum gray	41
Light yellow	75	Maroon	30
Light buff	66	Green	22
Light blue	65	Brown	16
Pale green	59	Red	13
Olive tan	43	Dark blue	9

Colors that tend to stress stability are best suited for use on machinery. Man's color associations antedate by many thousands of years his use of the printed word. He has learned to associate heat with the red of fire; freshness with the greens of vegetation; stability and solidity with the browns of the soil or the neutral grays of rugged cliffs and rocks. Thus it is only natural to portray, through colors, features that contribute to mental well-being and physical satisfaction.



Interior of auto coach in which practical low color values, flush knobs, handles and panels are used



Light gray color treatment contrasting with polished metal trim makes this oil burner, designed by Ray Patten, attractive and neat

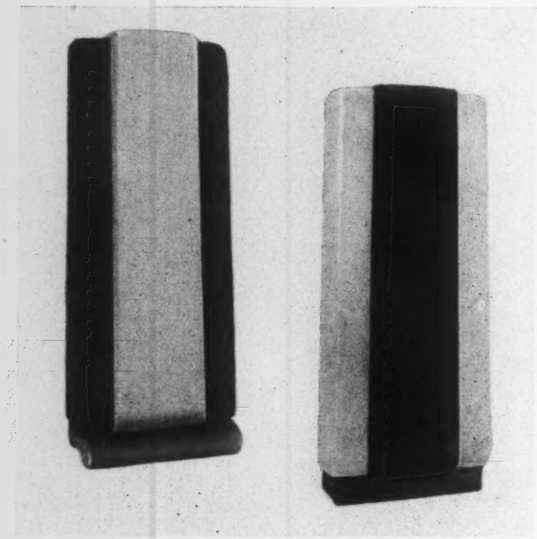
Cool-colored machines in cool-colored surroundings tend to divert to a helpful degree too great a consciousness of heat in work areas that are of necessity overheated. Obviously, colors that have been associated with the fragile, pale coloring of flowers convey no sense of suitability when applied to the surface areas of machinery of the heavier type. These colors fail to connote durability. Rather, the prospective purchaser will be deterred because of fragile appearance. Colors that are novel, providing they possess the above-mentioned requisites, will freshen the operator's interest and sustain his morale.

Colors Aid Memory

Color serves a notable role in enabling new operators to grasp more quickly the technique required for highly specialized machinery, as for example the painting of controls in a color sequence to indicate

** These readings were obtained on a photometer. They represent the diffused reflection of light from a colored surface as opposed to glare or specular reflection.*

their operating sequence. A lasting impression can be registered by the use of purple to color small handles and levers. Red, on the other hand, creates the least permanent impression, possibly because it is in such general use today. Red has its applications, however, and serves useful purposes as constant warnings on danger spots around machinery—moving parts, high voltages, etc. If the operatives are women, the best color memory response is attained by the use of dark blue. Dark green is the



Color treatments of a vending machine indicating how appearance may be controlled by two tones of color. Illusions of height or width can readily be effected as desired

least satisfactory color from a memory standpoint for the control pieces where women are employed.

The coloring of machines can have a marked psychological effect upon employes. A large and complicated looking machine can be made to appear even larger, more formidable and dangerous to the operator if it is improperly colored. On the other hand the proper combination of colors and their correct distribution can help to overcome undesirable prejudices.

Psychological Factors of Color

There are many instances where industrial coloration has reduced accidents, speeded production and reduced rejections. One example is typical: A manufacturer of radio tubes noticed that the rejections were very high at his stemming machines; by painting them an orange they became highly visible against gas flames. Then the walls were painted a cool value of blue. During the first week after this change in colors rejections dropped 60 per cent.

The effectiveness of color in imparting power over form and in differentiating between moving and stationary parts is fast becoming a factor of safety and convenience in many fields of machine design. The use of too much color, or colors that fail to reflect light efficiently, should be carefully avoided.

Fundamentally there are but six colors: Blue, red, green, yellow, black and white. Black and white are not actually colors but they influence the other four. No two colors are alike, and yet, since all color variations stem from combinations of them, all bear some relationship.

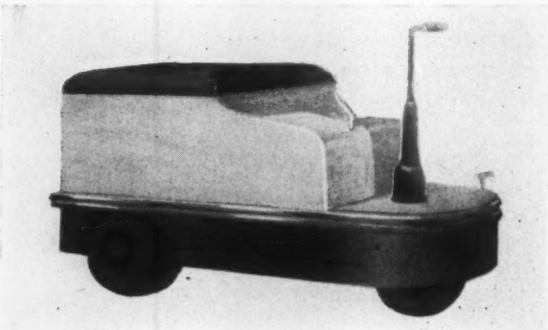
From the psychological standpoint of sensation there are the six colors and these seven shapes: The circle, semicircle, letter "S," spiral, wave line, broken line, straight line.

All things which we see are compounds or mixtures of these colors and design elements and our reactions thereto are favorable, unfavorable or negative. Consequently, a pleasing grouping of these elements in machine design and proper timing in their presentation can contribute to the serviceability and efficiency of any mechanical device.

Methods To Secure Contrast

In the art of color there are five ways for securing contrast:

1. If it is desired to give prominence to a certain portion or operating section of a machine so that it will receive special attention, it is necessary to treat those portions of the machine's surface with a light value color; the rest, with a low value (dark color). For example, a light orange for the area to be made prominent, and brown for the portions that are to serve as a background, provide an effective color contrast relationship.
2. The use of a color of weak (grayed) purity with a color of full strength or purity. For example: An olive green is a weak color while an emerald green represents a green of full hue



Increasing safety is important consideration in an industrial truck. Body color of high visibility set off by dark bands give attention value and impressive appearance to this truck

strength. Portions of a machine set apart in these two variations or representations of them in different hues will prove readily distinguishable.

3. The use of a warm color with a cold color:

(*Continued on Page* 60)

Load Characteristics of Rubber Mountings

Part II—Compression

By J. F. Downie Smith
Edward G. Budd Mfg. Co.

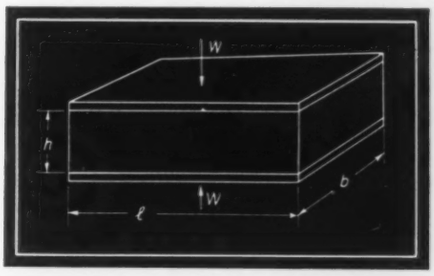


Fig. 1—Simple diagram is basis for theory that deflection of columns carrying equal unit loads and having equal cross sections is proportional to their heights

THEORETICAL analyses of shear loaded rubber mountings of several common shapes were made in the first installment of this article in M. D., August, and by introducing experimental values it was shown theory and practice agree remarkably well. It is not a simple matter at the moment, to calculate theoretically the deflection which a piece of rubber will give under a known compression load, but a few simple shapes have been considered by investigators and the conclusions reached can be readily summarized. Moreover, empirical equations for solving simple problems dealing with compression pads have been developed elsewhere and are stated briefly in this article. With them the deflections of some commonly encountered designs of compression rubber pads, vulcanized to metal, can be calculated. Several practical designs of rubber springs also will be presented.

RECTANGULAR SLABS. The solution proposed by Keys is best understood by reference to *Figs.* 1 and 2. In this analysis the area of one loaded face of a slab is called the "load-bearing area;" the area of the unconfined edges of the slab, including the walls surrounding unfilled holes, is called the "bulge area." The "area ratio" is the ratio given by load-bearing area/bulge area. For example, in *Fig.* 1 the load-bearing area is $l\ b$, and the bulge area is $2(l + b)h$. Therefore the area ratio equals $l\ b/2h(l + b)$.

By means of *Fig.* 2 it would be possible to obtain deflections for five typical rubber compounds of durometer hardness 30, 40, 50, 60 and 70. Means for interpolating between these values are not discussed.

Inherent in the above theory, and explicitly claimed by Keys, is the statement that "the deflections of columns of identical rubber compounds carrying equal unit loads and having equal cross sections are directly proportional to their respective heights." Since the whole theory is based upon this assumption it is unfortunate that it cannot be verified experimentally. Hirshfeld and Piron and the author have shown that quite appreciable errors would occasionally result.

For that reason the subject has been approached rather differently. *Fig.* 3 shows a series of curves for rectangular slabs of any ordinary dimensions and hardnesses. In the curves h = height of rubber slab

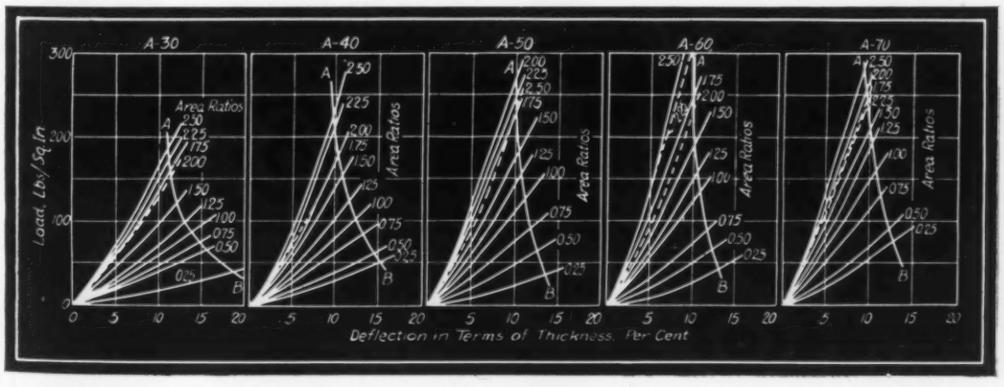


Fig. 2—Using the theory in Fig. 1 it is possible to obtain deflections for five typical rubber compounds with this multiple chart

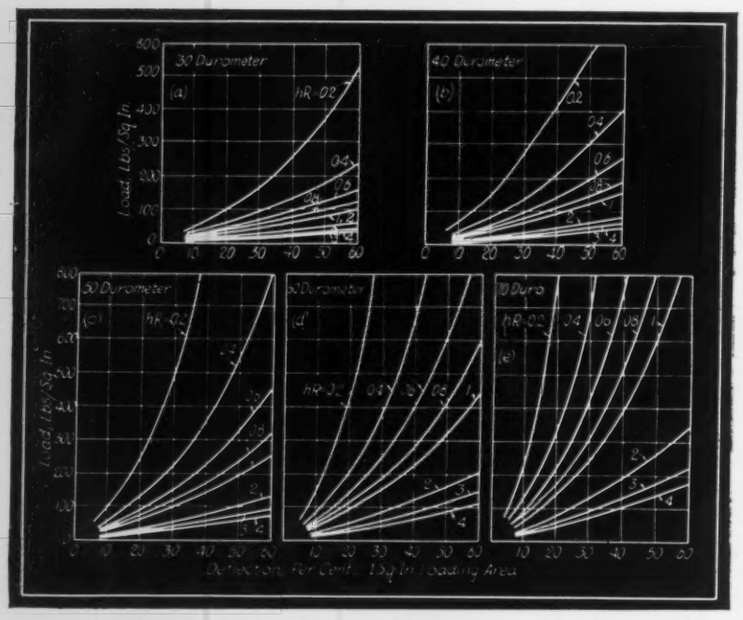
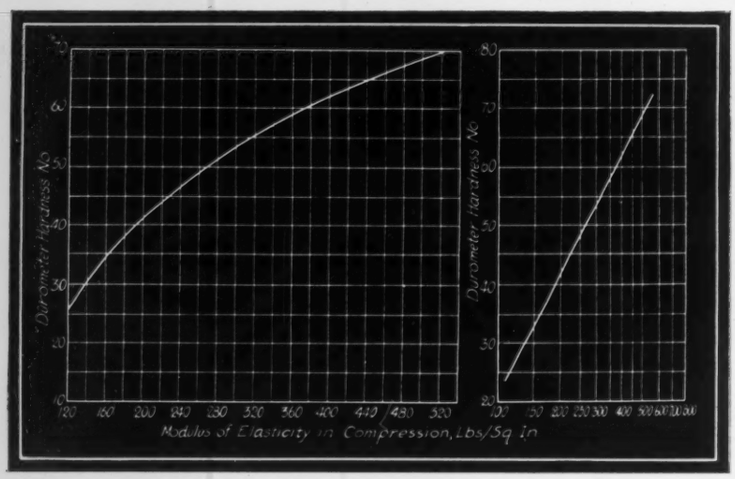


Fig. 3—A series of curves for rectangular slabs of any ordinary dimensions and hardnesses. All data are for loading area of one square inch.

Fig. 4—Below—Relationship between durometer hardness number and modulus of elasticity in compression. Percentage deflection varies inversely as the modulus of elasticity



in inches, R = ratio of long side to the short side of the rubber. All the data are for a loading area of 1 square inch and are limited to plain rectangular slabs without holes. In order to find the deflection for a slab with a loading area of A square inch, find the deflection for the given material and loading and divide the percentage deflection by $\sqrt{A}$.

For the purpose of interpolation in the charts for slabs of rubber hardness different from any shown, the relationship to use is that percentage deflection varies inversely as the modulus of elasticity in compression. The relationship between durometer hardness number and modulus of elasticity in compression is given in *Fig.* 4.

Notice that the modulus of elasticity in compression is three times the modulus of elasticity in shear for the same durometer hardness. This comes from the observed fact that Poisson's ratio is .5 within close limits over a wide range of deflection, for rubber is almost incompressible. An example or two will be helpful in understanding this chart.

Problem. What would be the deflection of a rubber slab of 50 durometer hardness, with a loading surface area of 6 inches x 4 inches and a height of .75-inch under a load of 5000 pounds?

Solution:

$h = .75$

$R = \frac{6}{4} = 1.5$

$hR = 1.5 \times .75 = 1.125$

Stress = $5000/(6 \times 4) = 208$ pounds per square inch.

From *Fig.* 3 (c), deflection on 1 square inch = 53 per cent.

Therefore, in our case, deflection = $53/\sqrt{6 \times 4} = 10.82$ per cent, and actual deflection = $10.82/100 \times .75 = .081$ inch.

Problem. If the hardness of the rubber of the previous problem had been 53 durometer instead of 50, what would then be the deflection?

From *Fig.* 4 it can be seen that E53/E50 = 294/264 = 1.114

Therefore deflection would be .081/1.114 = .073 inch.

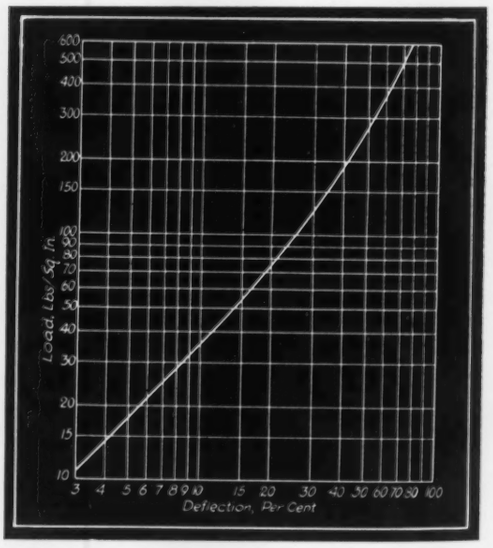
Occasionally the chart will be found to be of insufficient scope to cover special conditions, and additional calculation will be necessary. Under those circumstances the following statements may be used.

(1) The percentage deflection varies directly as the (height)$^{2/3}$, approximately

(2) The percentage deflection varies inversely as the (loading area)$^{1/2}$, approximately

(3) The percentage deflection varies inversely as the modulus of elasticity in compression

Fig. 5—Below—This curve is useful in obtaining the percentage deflection in special cases where Fig. 4 is found to be of insufficient scope



(4) The percentage deflection varies approximately as $R^{2/5}$, where R is the ratio of long side to short side of the rubber loading area. Combining these statements, we get:

The percentage deflection varies as $(hR)^{2/5}/A^{1/2}\,E_x$

In order to use this relationship a curve for a standard 1-inch cube block of rubber of 55 durometer hardness has been drawn, *Fig.* 5. All that is necessary to find the percentage deflection of a slab of rubber of height h, loading area A, length-width ratio R, and modulus of elasticity in compression E_x, is to multiply $(hR^{2/5}\ E55/A^{1/2}\ E_x$ by the percentage deflection of the 1-inch cube shown in *Fig.* 5 subjected to the same loading pressure. An example will illustrate the use of *Fig.* 5.

Problem: What would be the deflection of a rubber slab of 40 durometer hardness with a loading surface area of 7¾ inches x 5¾ inches and a height of ¾ inch under a loading pressure of 600 pounds per square inch?

From *Fig.* 5, at 600 pounds per square inch, percentage deflection of the standard block would be 81 per cent.

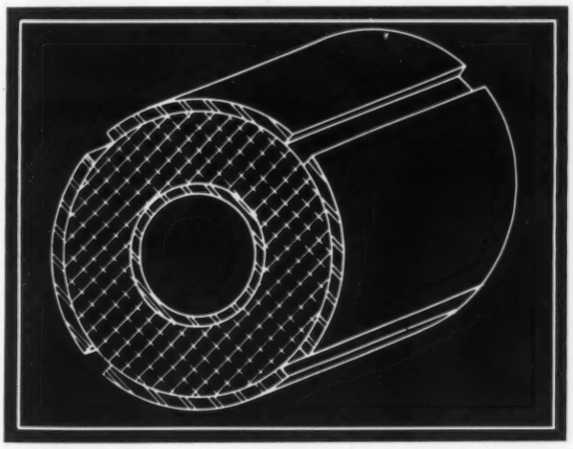
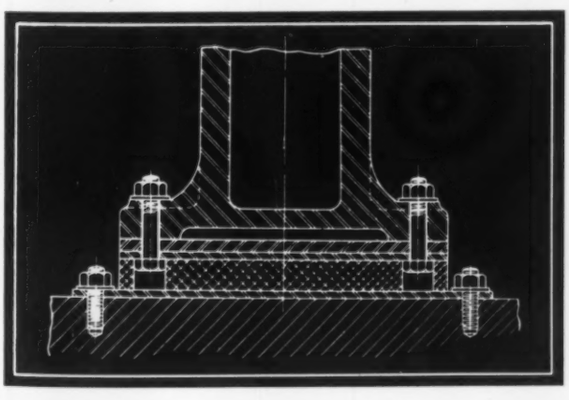


Fig. 7—To get compression on rubber during and after vulcanization, the outer sleeve of torsion bushings is sometimes split. Fig. 8—Below—A common compression mounting with obvious advantages



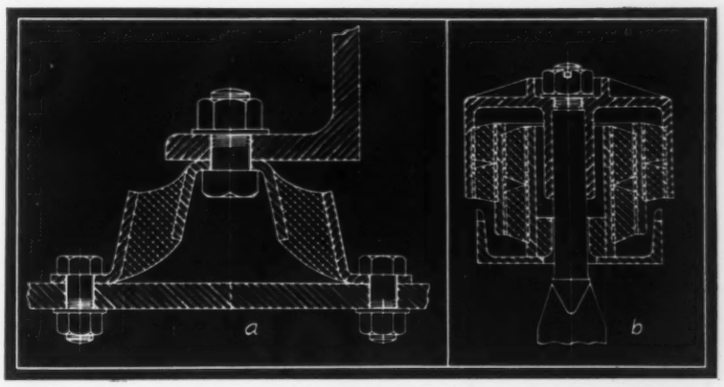


Fig. 6—Practical shear rubber designs, section (a) being a common type. Section (b) gives an increase in deflection over that obtainable with a single cylindrical shear bushing

Therefore, required percentage deflection

$$= \frac{81\ \left(.75\times\frac{7.75}{5.75}\right)^{2/5}}{(7.75\times5.75)^{1/2}}\ \times\ \frac{313}{190} = 20.1\ \textit{per cent}$$

Actual deflection $= .201 \times .75 = .15$ inch.

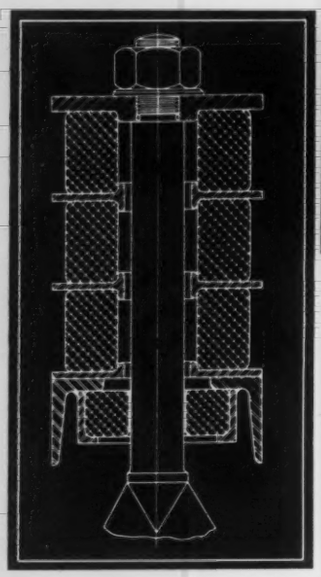
A simple method of calculation of compression pads has been proposed by Haushalter for a limited group of slabs. In his scheme he calls the width of the maximum cross section of the rubber the effective width. For example, for a 1-inch cube, this would be 1-inch; for a rectangle 3 inches x 1 inch the value would still be 1 inch; for a perforated slab it would be the distance between holes; for a hollow cylinder it would be the wall thickness of the cylinder; and for a solid cylinder it would be the diameter.

It is Haushalter's claim that where the ratio of height to effective width of rubber is equal to 1 or a little less, the load-deflection curve is practically a straight line up to 20 per cent deflection; and under those conditions the modulus of elasticity in compression is approximately 6.5 times the shear modulus of elasticity. Haushalter has shown that his method applies quite well even for cylinders, either hollow or solid, so long as the ratio of height to effective width is nearly 1.

Several designs which have been used successfully in practice are illustrated in *Figs.* 6 to 10 inclusive.

SHEAR MOUNTINGS. *Fig.* 6 gives shear rubber designs, section (*a*) showing a type which is quite common in industry. The material is formed in lengths of several feet and is cut to the required dimensions. The same picture could also illustrate a cylindrical shear bushing. In order to increase the deflection over that obtainable with a single cylindrical shear bushing the type shown in *Fig.* 6 (*b*) can be adopted.

TORSION BUSHINGS. *Fig.* 7 illustrates a torsion bushing. In order to get compression on the rubber dur-



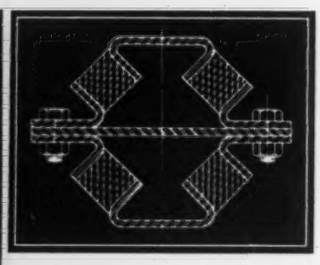


Fig. 9—Left—When a single pad of rubber gives insufficient deflection, compression pads may be used in series. Fig. 10—Above—Combination of shear and compression pads. A single design is also possible

ing and after vulcanization the outer sleeve is split by some rubber companies. Others prefer solid sleeves.

COMPRESSION MOUNTINGS. *Fig.* 8 deals with a compression mounting, adequately described by the drawing. Frequently a single pad of rubber will not give sufficient deflection for a particular purpose, and *Fig.* 9 shows designs using rubber compression pads in series. The same height of rubber could not have been used in one piece or it would have been unstable. Notice in *Fig.* 9 that the rubber has to be held away from the inner metal rod.

COMBINATION SHEAR AND COMPRESSION. Sometimes a combination of shear and compression pads is encountered. Such a device is illustrated in *Fig.* 10, which is manufactured in lengths and cut to suit. This particular design is double, but obviously it could be used singly if either the top or bottom half were removed.

With the exception of the two short curves on *Fig.* 1, Part I, which were obtained from the Continental Gummi-Werke Aktiengesellschaft, of Hannover, all of the data on shear loading of rubber were obtained at the plant of the E. G. Budd Mfg. Co.

The practical designs of *Figs.* 6 to 10, Part II inclusive, were obtained from several sources. *Figs.* 6 (a) and (b), 7, 8, and 9 in Part II were supplied by the Continental Caoutchouc-Compagnie G. M. B. H., of Hannover; and *Fig.* 10, Part II, by the Goodyear Tire and Rubber Co. Inc.

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Snow Cruiser To Aid Byrd Expedition

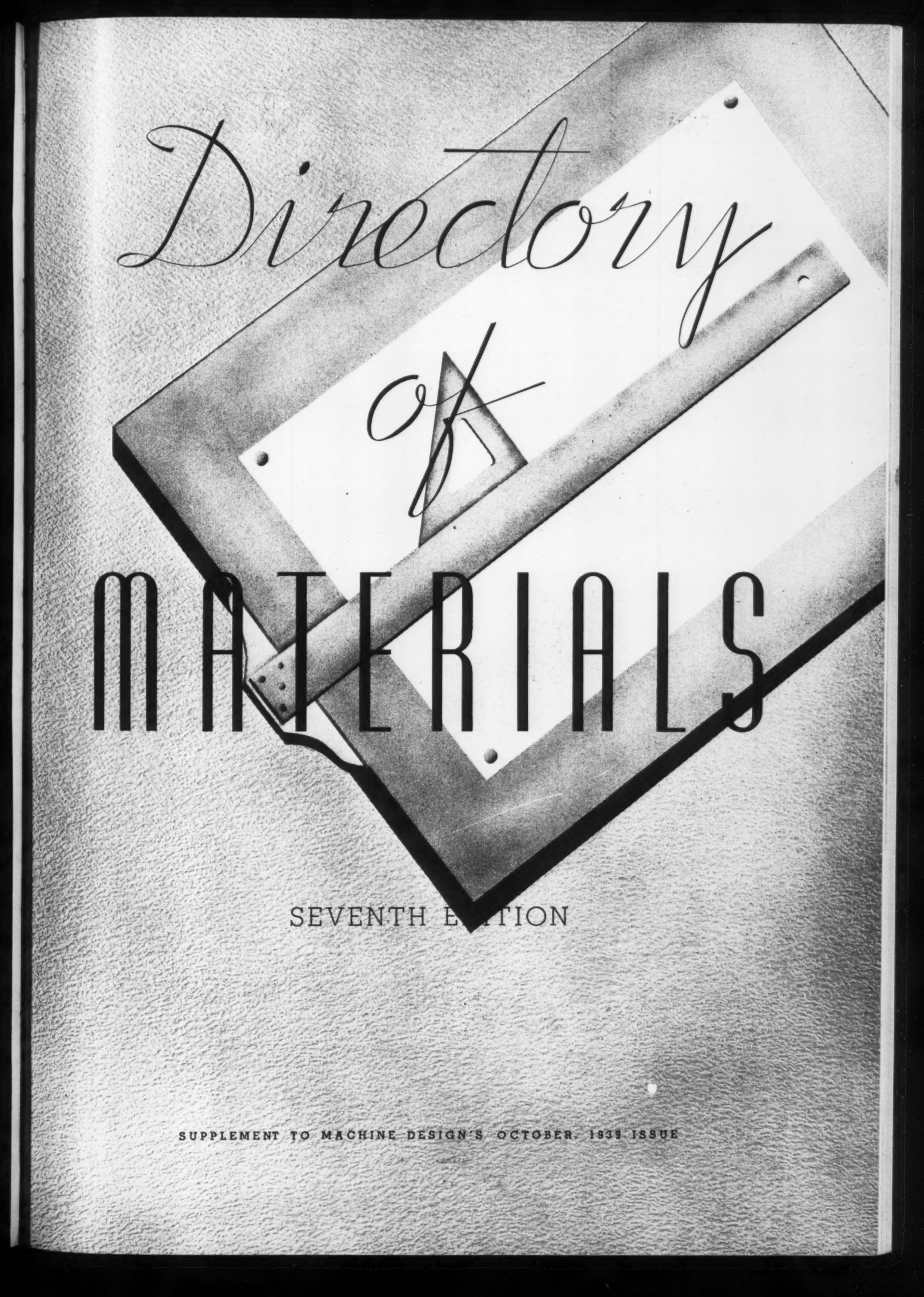
ANTARCTICA, strange land surrounding the South Pole, will be the scene of operations of an equally fantastic mechanical monster, known as the "Snow Cruiser," when the next Byrd expedition reaches it late this fall.

Designed by the Research foundation of Armour Institute of Technology, Chicago, the Snow Cruiser is expected to overcome any weather or topographical conditions which may be encountered. It contains commodious living quarters, scientific apparatus, and all conveniences for a crew of from three to six. With a cruising range of 5000 miles at a speed of from 5 to 30 miles per hour, the machine will permit operations for a period of one year without contact with the outside world. A five-passenger airplane, equipped as a flying scientific laboratory, will be carried on its back.

Costing $150,000, the Snow Cruiser is 55 feet 8 inches long overall, and 19 feet 8 inches wide. Rolled sections of high strength, low alloy steel with a maximum carbon content of .12 per cent, have been electric arc welded to form the entire frame, wheels, floor plates and the outside sheathing covering the runners.

The machine is mounted on four rubber-tired wheels, each 10 feet in diameter and weighing between 1000 and 1200 pounds, carrying a rolling load altogether of more than 37 tons. Wheels turn on bearings of 24-inch bore and 32-inch overall diameter, with a load capacity of 91,000 pounds at maximum speed, 120,000 pounds at normal speed. Wheels are individually driven by 60-horsepower electric motors installed in the hollow wheel spindles, each motor developing 100 per cent overload and providing a tractive effort of 5000 pounds. Power for the motors comes from two 150-horsepower diesel engines connected to electric generators. The same source supplies power for lighting and other requirements. Right-angle bevel gear drives incorporating suitable speed reduction, transmit the power from the electric motors to large ring gears attached to the inner surfaces of the wheels, making each wheel a self-contained power unit.

Entire operation of the unit is handled from the control room by one man. Hydraulic steering is used, with the front wheel steering independently of the rear wheel, giving a turning radius of 30 feet. Hydraulically-operated devices enable the wheels to be retracted, singly or in pairs, like landing wheels of an airplane. In crossing crevasses as wide as 15 feet, the cruiser will be driven forward until the front of the cabin is over the snow on the opposite side. The front wheels will then be raised and the front end allowed to rest on the snow. Rear wheel traction will slide the machine forward until the front wheels have crossed the crevasse, after which they will furnish pulling power while the rear wheels are raised.



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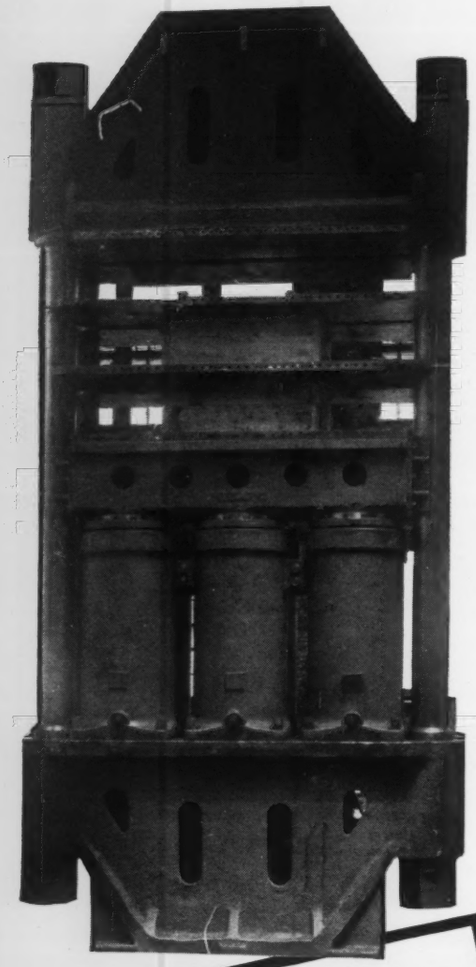

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IN ACID SERVICE— In most commercial acids, corrosion resistance of Grade 18 Ampco Metal is unexcelled. Acid valves, pump liners and other parts, pickling crates, racks, and chains of Ampco are being widely used throughout the industrial field. Write for recommendations relative to any specific acid.

FOR FORMING AND DRAWING DIES— Most stainless steel manufacturers recommend Ampco for forming and drawing their products, and Ampco is effecting economies in the working of ordinary steel as well as zinc, aluminum, German silver, sterling silver, tantalum, and Monel Metal. Ampco Grades 21 and 22 are the only copper-base alloys produced which are hard enough and strong enough for this service. They serve better because they do not gall or load, and provide bearing action in die service. Ampco dies customarily outwear hardened steel: die maintenance and finishing costs are greatly reduced.

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FOR BEARINGS— Ampco Metal is being widely used in this service throughout the country for difficult applications. It is not usually recommended for service under conditions of poor lubrication, but where lubrication is adequate Ampco will far outwear ordinary bronzes. Grade 16 is most widely used for bearing service. For high speed service against soft shafts, Grade 12 is recommended; for heavy duty service, Grade 18; while Grade 21 is used in place of hardened steel.

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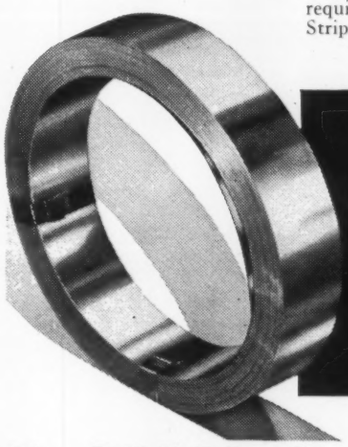

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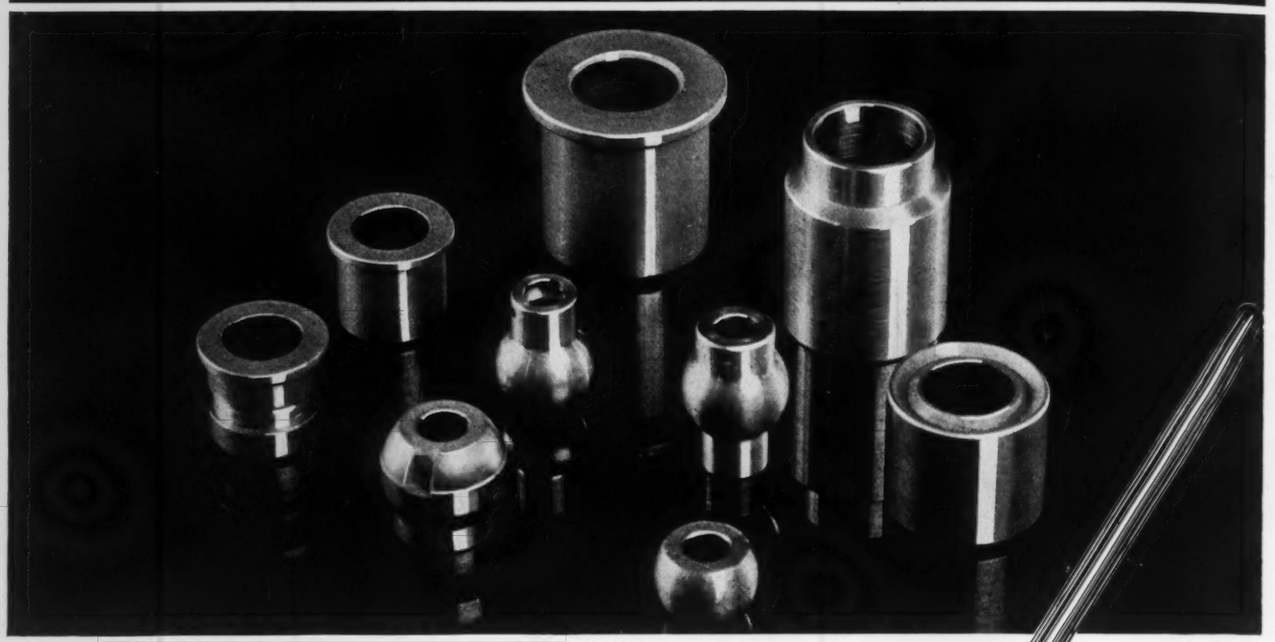
UNITED STATES STEEL

Controlled Lubrication



JOHNSON

Ledaloyl

SELF LUBRICATING

BEARING BRONZE

FREE

The complete story of Johnson LEDALOYL is yours for the asking — Write today for your copy — no obligation.

● Johnson LEDALOYL Bearings last longer . . . perform more efficiently . . . because lubrication is automatically controlled. Millions of pores, evenly spaced, provide *pin-point* lubrication to the entire bearing area. The minute size of the pores *meters* the lubricant in the exact amount required for efficient operation at all speeds and loads. Likewise, the bearing absorbs the oil when the shaft is at rest. Thus you have the right amount of oil . . . in the right place . . . at the right time. There is no waste of lubricant, no seepage, no damage to goods in process.

Through the development of our exclusive process of PRE-ALLOYING certain basic metals, we are able to give you a bearing that is homogeneous; that contains both lead and graphite . . . and holds up to 35% oil, by volume. We invite your comparison of LEDALOYL with any sintered bronze on the market. Convince yourself that no other bearing will equal the long life, the quiet operation, and the smooth performance of LEDALOYL. Your inquiry carries no obligation.

The MOST COMPLETE SLEEVE BEARING SERVICE in the world

JOHNSON BRONZE COMPANY

Sleeve BEARING HEADQUARTERS

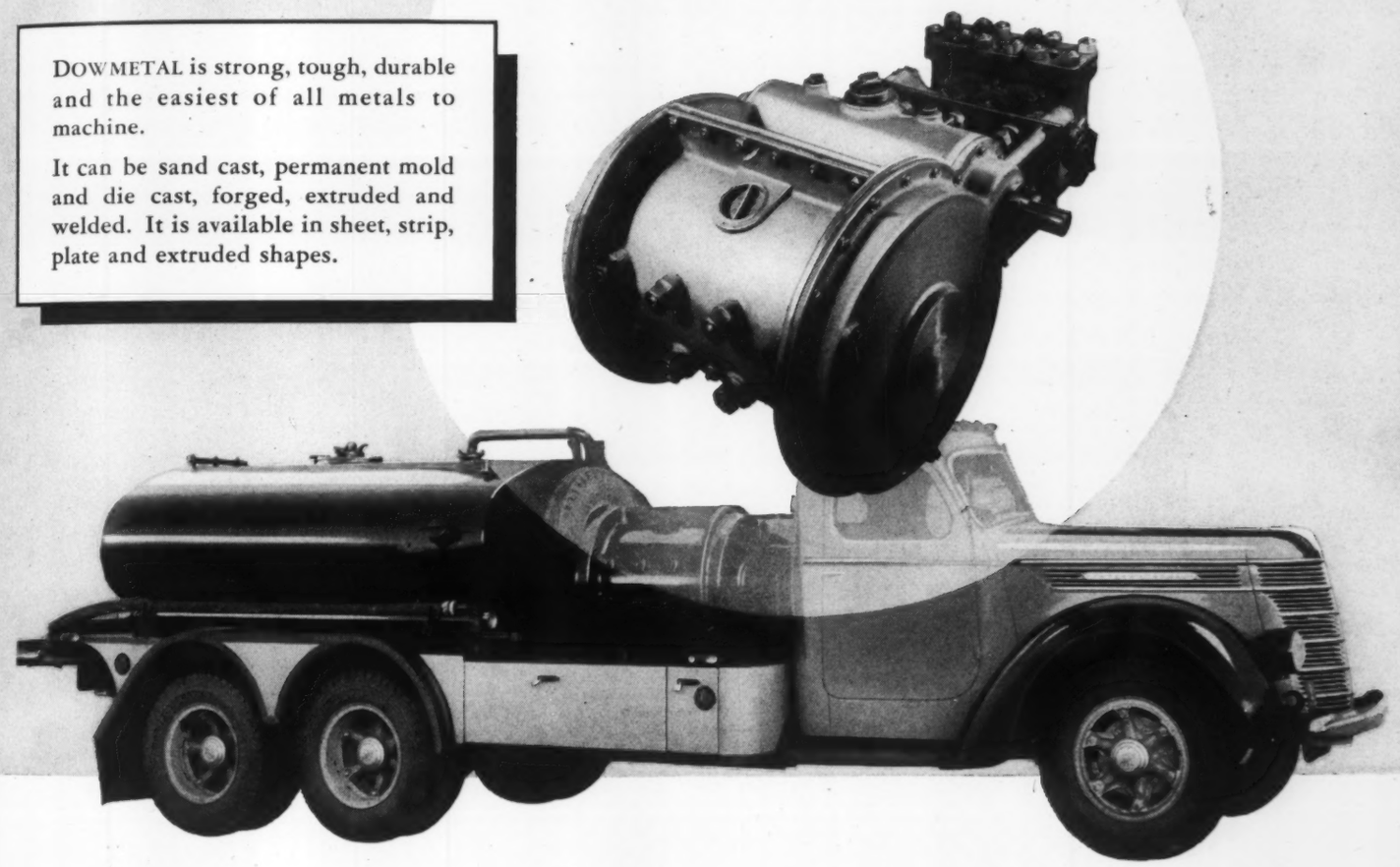
525 SOUTH MILL STREET • NEW CASTLE, PA.

Dowmetal's *Lightness*

STREAMLINES THE WEIGHT OF PRODUCTS

DOWMETAL is strong, tough, durable and the easiest of all metals to machine.

It can be sand cast, permanent mold and die cast, forged, extruded and welded. It is available in sheet, strip, plate and extruded shapes.



EVERY CHAMPION has to train down needless weight. That is just as true of products as of people.

Take the case of this big high pressure triplex pump. It's carried as equipment by the trucks of a special tank fleet that transport chemicals for treating oil wells. To maintain truck capacity for payload it was essential that the pump be light. So the Union Steam Pump Company chose DOWMETAL* for all the pump castings. The result: it lightened the pump by 2200 pounds!

In more than three years of bruising service in the oil fields, no failure has ever been chalked up against these pumps. That's the kind of record-breaking strength and toughness that goes hand in hand with DOWMETAL'S extreme lightness.

A full third lighter than any other structural metal, DOWMETAL leads the list of all metals in its ability to streamline the weight of products. See how DOWMETAL'S lightness can give your product greater efficiency and sales appeal. Send for the illustrated DOWMETAL booklet, "Industry's Lightest Structural Metal," today.

THE DOW CHEMICAL COMPANY
1760 EAST MAIN STREET
MIDLAND *Dowmetal Division* MICHIGAN

Branch Sales Offices: 30 Rockefeller Plaza, New York City; Second and Madison Streets, St. Louis; Field Building, Chicago; 9 Main Street, San Francisco; 4151 Bandini Blvd., Los Angeles.

DOWMETAL
MAGNESIUM ALLOYS

INDUSTRY'S LIGHTEST STRUCTURAL METAL

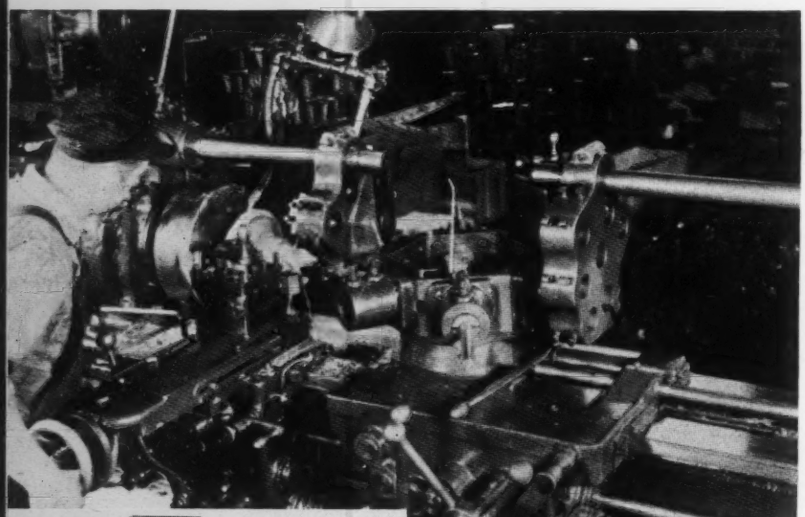
*Trade Mark Reg. U. S. Pat. Off.

Be sure to visit the Dowmetal Booth at the National Metal Congress and Exposition in Chicago, October 23 to 27.

Visit exhibits of The Dow Chemical Company and its Great Western Electro-Chemical Company Division at the Golden Gate International Exposition

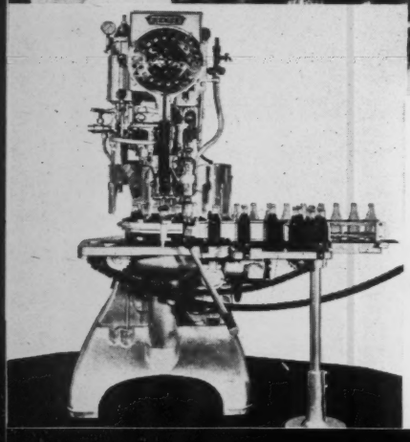
BUYERS OF YOUR EQUIPMENT

expect two things of it:



That it will operate up to their expectations; that it will operate efficiently under whatever unusual conditions exist in the case of a particular user. A policy of product improvement that calls for the use of more forgings in mechanical equipment *underwrites the user's expectation* of dependable performance under a wide variety of operating conditions. Forgings contribute vast resources of strength, a greater margin of safety, higher fatigue resistance for vital parts, and several other quality advantages to whatever item of mechanical equipment of which they become a part. This is so because forging kneads metal into a dense mass of hoarded strength—strength that is achieved through a concentration of grain structure and fiber formation at points of greatest shock or strain. Furthermore, with forgings, uniformity of physical properties is obtainable in exact degree desired, before or after heat treatment. Frequently, forgings reduce parts cost by lowering machining costs, and reducing rejects to a minimum, since forgings are free of concealed defects.

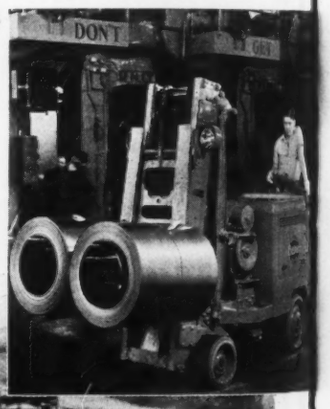
Consult a competent forging engineer about other quality advantages of forgings. Write this office if you need help in getting in touch with a forging engineer.



Forged Gears Furnish Uniform Gear Tooth Strength In Gisholt Turret Lathes. In service, these forged gears were found to have a strength double the safe load. Such is the margin of strength secured with forgings. Or, as the Gisholt Machine Co. puts it: "...With a given material and section, only by the use of forgings can such results be obtained."

Cams, gears, levers, and yokes of "Dixie" Bottle Washing Machines are forged to provide toughness and wear resistance. The Crown Cork & Seal Company writes: "...lasting quality is built into the 'Dixie' in the form of special wear resistant and corrosion resistant material and many of these parts have steel forgings noted for their extra toughness and wear resistance."

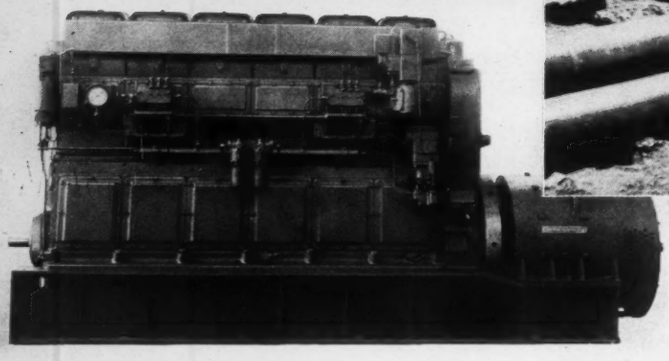
Forgings fortify Baker Industrial Trucks against strains and stresses encountered in operation. The Coupling between the drive motor and main driving worm, the wheel hub flanges, differential carriers, universal joint forks, differential spiders, bevel gears and steering knuckle, are all forged.



Merco Nordstrom valve installations reduce maintenance cost on oil, gas and chemical systems! This company says: "Forgings are stronger and more resistant to shock, cheaper in mass production, freedom from porosity, tightness against leakage for pressure vessels."

Use More Forgings

Forged Connecting Rods In Giant Size Cooper-Bessemer Gas and Diesel Engines Protect Customer Good Will! In both their Diesel and Gas engines, Cooper-Bessemer engineers realize definite qualities through employment of forgings. This is clearly shown by their comment that "forgings provide parts of greater strength, longer life and with fewer defects." And, with regard to production advantages, they say, "Less finishing, fewer field complaints and a reputation for better rods."



Hundreds of engineers, designers, metallurgists, production executives, and management executives are receiving "Drop Forging Topics" regularly. Are you? If you are not, and you belong to one of these groups, send us your name today. It is sent free.

THERE ARE NO SUBSTITUTES FOR FORGINGS

DROP FORGING ASSOCIATION

605 HANNA BUILDING · CLEVELAND, OHIO

SYMBOLIC EMBLEM OF THE DROP FORGING ASSOCIATION

The Story *of the* Puzzling Pump

AND HOW DU PONT NEOPRENE HELPED TIMKEN MAKE IT FOOLPROOF

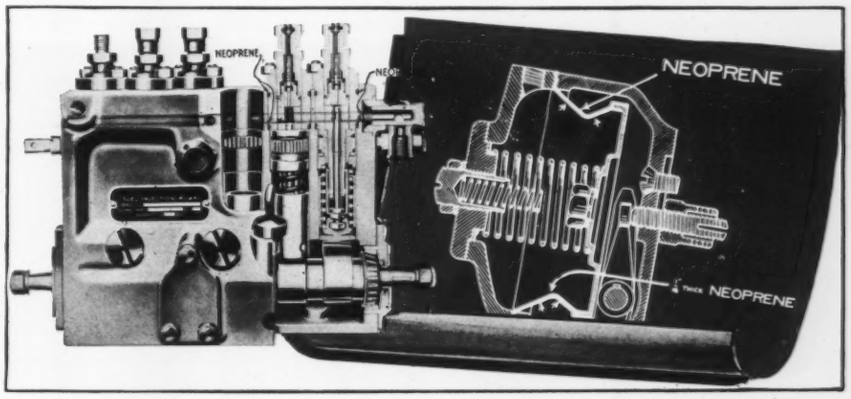
A FEW YEARS AGO, the Executive Engineer of a leading machine parts manufacturing concern was making an inspection trip through a branch factory when he was hailed by a group of men in a corner of the power house.

"Come take a look at this sick diesel fuel injection pump," they said. "Can we fix it, or shall we just take it out and give it a decent burial?"

The Executive Engineer looked at the pump and scratched his head. You know what he was up against . . . for in those days a fuel injection pump was as complicated as a Chinese puzzle.

"Boys," he said finally, "you've got me. Better wire the people who made it. And I'm going to see what I can do about getting a simplified yet efficient pump."

He did. Others did too. And that's what led the Timken Roller Bearing Company to design a fuel injection pump so simple and reliable that almost any mechanic could understand it. In this new pump the number of separate parts was minimized. Whole sections were made easily replaceable.



One of the factors which made this improved pump possible is the unique performance of neoprene, Du Pont's chloroprene rubber, in the presence of oil and heat. Neoprene sealing units are used extensively . . . in the mechanical governor, in the center shoulder of the pumping unit, on the control shaft, and in many other places. In the vacuum-type governor, too, neoprene is an important part of the bellows and diaphragm assembly.

So, thanks in part to neoprene, fuel injection pumps are available that aren't necessarily puzzling... one of the thousands of cases where neoprene has helped solve design problems. We hope that this story will suggest ways in which neoprene can be useful to you too. Keep abreast of new uses of neoprene by writing for your subscription to the free, monthly, newsy "Neoprene Notebook."

DU PONT

NEOPRENE

E. I. du Pont de Nemours & Co., Inc.
Rubber Chemicals Division
Wilmington, Delaware

MODERN MACHINES ARE EXPECTED TO BE QUIET!

WHILE retaining the simplicity and dependability of gear drive Formica gear material makes it possible to produce machines that are much quieter in operation than those driven by metal gears. That makes the machines easier to sell. It helps maintenance men keep them running smoothly and sweetly as they should.

There has been a steady increase in the employment of this type of drive. It increases gear cutting tolerances and speeds up production.

Replacement gears are available from the gear cutters named. They can usually make prompt delivery.

THE FORMICA INSULATION CO., 4648 SPRING GROVE AVE., CINCINNATI, O.

FORMICA

FORMICA GEAR CUTTERS

•

The Akron Gear & En'g Co.
Akron, Ohio

Farrel-Birmingham Co., Inc., Buffalo, N. Y.

Slaysman & Company
Baltimore, Md.

Harry A. Moore
Bangor, Me.

The Union Gear & Mch. Co.
Boston, Mass.

Chicago Rawhide Mfg. Co.
Chicago, Ill.

Perfection Gear Company
Chicago, Ill.

Gear Specialties, Inc.
Chicago, Ill.

Merkle-Korff Gear Co.
Chicago, Ill.

Chicago Gear Works
Chicago, Ill.

Foote Gear Works
Cicero, Ill.

The Cincinnati Gear Co.
Cincinnati, O.

Clarksville Foundry & Machine Co.
Clarksville, Tenn.

The Horsburgh & Scott Co.
Cleveland, O.

The Stahl Gear & Machine Co., Cleveland, O.

The Master Electric Co.
Dayton, O.

Boal Foundry & Machine Co.
Ft. Smith, Ark.

C. A. Lawton Company
DePere, Wis.

The Adams Company
Dubuque, Ia.

Hoell Machine Co.
Green Bay, Wis.

Hartford Special Mchny. Co.
Hartford, Conn.

Beaty Machine Works
Keokuk, Ia.

The Generating Gear Co.
Milwaukee, Wis.

Badger State Gear Co.
Milwaukee, Wis.

Precision Machine Co.
Milwaukee, Wis.

E. A. Pynch Co.
Minneapolis, Minn.

Joaquin Alemany Lopez
Havana, Cuba

Kennedy & Bowder
Nashville, Tenn.

Natisch Gear Works
Brooklyn, N. Y.

New Jersey Gear & Mfg. Co.
Newark, N. J.

Prager, Inc.
New Orleans, La.

J. Morrison Gilmour
New York City

Sier-Bath, Inc.
New York City, N. Y.

Mid-State Electrical Engineering Co.
Osceola Mills, Pa.

Puritan Machine Co.
Omaha, Neb.

E. M. Smith Machine Co.
Peoria, Ill.

The Eagle Gear & Mch. Co.
Philadelphia, Pa.

Rodney Davis and Sons
Philadelphia, Pa.

The Pittsburgh Machine & Supply Co., Pittsburgh, Pa.

Perkins Machine & Gear Co.
Springfield, Mass.

Winfield H. Smith, Inc.
Springville, N. Y.

Alling Lander Company
Sodus, N. Y.

Charles E. Crofoot Gear Corp'n, South Easton, Mass.

Arlington Machine Co.
St. Paul, Minn.

Farwell Mfg. Co.
Toledo, Ohio

Diefendorf Gear Corp.
Syracuse, N. Y.

Batson Cook Co.
West Point, Ga.

Worcester Gear Works
Worcester, Mass.

Massachusetts Gear & Tool Co., Woburn, Mass.

Buckeye GRAPHITED BEARINGS *and* BUSHINGS

are intended for use in out of the way places where proper lubrication is apt to be neglected—in food mixing and other processing machinery when contact with oil and grease would be harmful to the material being handled—and on shafts turning at speeds so slow that maintenance of a constant film of lubricant would be difficult. Typical Buckeye quality throughout—free reaming. Four designs, including Style "S" as pictured above, "Fig. 8" and "Plug" types. Wide range of sizes. Prompt shipment. Write for full details.

No order is too big or too small for Buckeye

OTHER BUCKEYE PRODUCTS

include 851 sizes of finished, ready-to-use bushings, 160 sizes of electric motor bushings completely finished to factory specifications, 154 sizes of cored and solid bars—stocked for your convenience in all principal cities . . . also special bearings in an infinite variety of shapes, sizes, and bearing metal analyses to meet any specification.

Let us quote on your requirements.

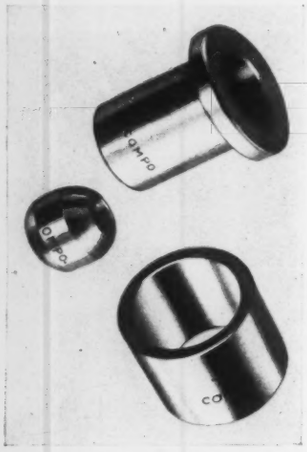
Buckeye

BRASS AND MANUFACTURING COMPANY

BRONZESMITHS SINCE 1900

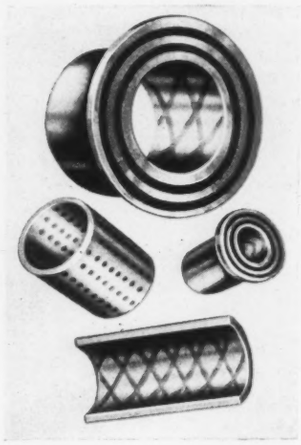
6412 HAWTHORNE AVE. CLEVELAND, OHIO

The Big-Three



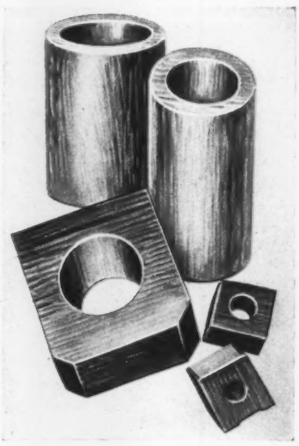
COMPO

Oil-retaining porous bronze bearings—maintain an oil film without the use of oil holes or grooves—prevent metal to metal contact—lubrication where you want it when you want it, because they contain up to 35% of lubricant in their porous structure. Made by die-pressing pure metal powders to shape, alloying at high temperatures and finishing to great accuracy. Write for bulletin.



BOUND BROOK

Graphited-Bronze Bearings—cast phosphor bronze inlaid with hard, enduring graphite lubricant in grooves or holes of various designs. Cover the shaft with a film of graphite; reduce friction and maintain bearing service in inaccessible or remote spots. Bearings that will stand the gaff in a variety of severe applications.



NIGRUM

Impregnated Hardwood Bearings. Quiet, Non-Metallic, Economical, Trouble-Proof. Made by a distinctive process whereby the pores of selected northern hard maple are completely filled with a specially prepared lubricant. Give smooth, lasting, efficient and uninterrupted service without oiling or attention. An interesting illustrated bulletin will be sent to any engineer requesting a copy.

The Bound Brook Engineering Service Department and Testing Laboratory, with a vast library of Bearing Application Data, Invites Correspondence with Designing and Production Engineers particularly on problems of remote or inaccessible bearings. We have tools and dies on hand for making thousands of sizes of Plain, Flanged, Self-Aligning and Special Shapes of Oil-Retaining Bearings.

▼ ▼ ▼

BOUND BROOK OIL-LESS BEARING CO.

BEARINGS • BUSHINGS • WASHERS • BRONZE AND ALUMINUM CASTINGS

Manufacturers of COMPO Oil-Retaining Porous Bronze, BOUND BROOK Graphited Bronze and NIGRUM Impregnated Wood Bearings. Also Plain Bronze Bearings and Castings • Established 1883

SALES AND SERVICE DETROIT, MICHIGAN — Main Office: Bound Brook, N. J. — SALES AND SERVICE LOS ANGELES, CAL.

"LOTS OF NEW TRICKS FOR FALL SHOWS!"

It's a long time between shows! Time enough for the Nickel-base alloys to turn out a number of new and unusual products. • Interesting to any engineer is the way these metals are now being used to prolong the life and improve the performance of various kinds of equipment and reduce manufacturing and upkeep costs, as shown by these examples:

"K" MONEL*... hardened by heat treatment, is used for non-lubricated anti-friction ball and roller bearings. These bearings offer excellent service in machinery and equipment exposed to salt water and other corrosives encountered in chemical and similar industries. Also in the food and such industries where products must be guarded against contamination.

"S" MONEL*... is providing economical service in power plants as cast valve trim and other parts. Even at 900° F., where ordinary materials are not of much use, cast "S" Monel still possesses great hardness, and offers stout resistance to galling and wear.

"Z" NICKEL*... in the form of wire rope offers an unusual and valuable combination of properties: The strength of high carbon plow steel, great endurance under repeated flexure, and in addition, immunity to rust.

INCONEL*... is widely used for light weight airplane exhaust manifolds. Retaining exceptional strength at high temperatures, and resisting both oxidation and corrosion, it withstands the destructive effects of hot exhaust gases, and outlasts other materials.

How can *you* utilize the Nickel-base alloys to improve performance and cut costs? Qualified technical men at the INCO booth will gladly help you find out. • Take advantage also of the fall INCO technical publications available at the Fall Shows. If you can't make the shows, let us send you the information by mail. Address:

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York, N. Y.

FALL SHOWS

NATIONAL METALS EXPOSITION
International Amphitheatre, Chicago

• • •

EXPOSITION OF CHEMICAL INDUSTRIES
Grand Central Palace
New York

MONEL

*"Monel" and other trade-marks which have an asterisk associated with them are trade-marks of The International Nickel Company, Inc.

Preface and Contents

FEW greater opportunities have arisen for the presentation of a directory of materials than during the current period of crises and emergencies. With overwhelming demand for equipment which will unquestionably be felt due to war-time conditions, the equally overwhelming demand for metallic and nonmetallic materials can only too well be realized.

Now in its Seventh Edition, MACHINE DESIGN'S directory is arranged as a ready reference supplement for chief engineers and designers of machinery manufacturing companies. Following established practice the directory is stitched into the magazine proper in such a way that it can be removed without damage to either.

Many new listings of metallics and nonmetallics are included in the current directory, as well as complete revisions of materials appearing in earlier editions. The newer sections covering stampings, forgings, die castings and custom molders are considerably enlarged through the addition of numerous items and more complete details.

Page numbers of the sections of the directory are:

Iron, Steel and Nonferrous Alloys 15-D
Plastics and Other Nonmetallics 34-D
Iron, Steel and Nonferrous Producers 40-D
Plastics and Nonmetallic Producers 42-D
Stampings Producers 44-D
Forgings Producers 50-D
Die Castings Producers 56-D
Custom Molders 60-D

Numerals are used in both the metallic and nonmetallic sections of the directory, above each listing, to classify the properties of the materials and to aid in their selection. Where numerals are shown only on the line immediately above the tradename, all types or grades produced under that tradename possess the properties designated by the numerals. When properties vary with the grades, classifying numerals appear above each individual grade to designate the three major properties of each. Additional properties are given, in many instances, in the text.

New alloys, specially-processed irons and steels, plastics and other nonmetallic engineering materials will be announced as they are developed, in the "New Materials and Parts" section of MACHINE DESIGN'S regular issues.

Copyright, MACHINE DESIGN, 1939

Iron, Steel and Nonferrous Metals Listed by Tradenames

(For listing by producing companies, and complete street addresses, see Page 40-D)

A

1 - 3 4 - - - - - -

ABRASOWELD—Lincoln Electric Co., Cleveland. Arc-welding electrode for providing abrasion resisting, self-hardening deposit which hardens rapidly under impact and abrasion; maximum hardness develops at surface, leaving cushion of softer metal beneath; provides resistance to abrasion in straight carbon, low alloy or high manganese steel surfaces; effective on gear and pinion teeth.

1 2 3 4 - - - - - -

ACME—Acme Steel Co., Chicago. Stainless strip steel.

1 2 3 - - - - - - -

Type 410; chromium 10 to 13.5, carbon .12 max., silicon .5, manganese .5, phosphorus and sulphur .03.

Type 430; chromium 14 to 18, balance of analysis same as Type 410.

1 - 3 4 - - - - - -

Type 302; chromium 17.5 to 19, nickel 7 to 8.95, carbon .08 to .20, balance same as Type 410.

Type 304; chromium 17 to 19, nickel 7 to 9.5, carbon .08 max., balance of analysis same as Type 410.

- - - 4 5 6 - - - -

ACORN—A. W. Cadman Mfg. Co., Pittsburgh; babbitt metal furnished in ingots; brinell hardness 70 degrees Fahr. 23.8, 212 degrees Fahr. 21.8; compressive strength 12,500 lbs. per sq. in.; for bearings having reciprocating motion, subject to excessive pound or vibration.

- - 3 - - - - - - -

ADAMANTINE—Babcock & Wilcox Co., New York. Special steel castings with wear-resisting qualities and machinable surfaces; for grinding mills, mixers, conveyors, power shovels.

- - - - - - 6 - - -

ADAMANT SUPER-GENUINE BABBITT—Magnolia Metal Co., Elizabeth, N. J. Over 90 per cent tin, free of lead, containing special fluxes; furnished as ingots; specific gravity 7.34; bearing properties good; brinell hardness, untreated 22.8; used for bearings, diesel engines, connecting rods, etc., subject to shock or strain.

- - 3 - - - - - - -

ADAMITE — Mackintosh-Hemphill Co., Pittsburgh. Alloy steel characterized by strength plus wear resistance.

- 2 - - - - - - - -

ADAMITE IRON — Mackintosh-Hemphill Co., Pittsburgh. A wear and heat resistant iron.

1 2 - - 5 - - - - -

ADNIC—Scovill Mfg. Co., Waterbury, Conn. Copper 70, nickel 29, and tin 1; furnished in rods, bars, tubes, wire, sheets, strips and plates for stamping, turning, boring, welding, deep drawing, cold heading, and brazing; resists corrosion due to organic acids, alkalies, sulphur compounds; resists heat up to 600 deg. Fahr.; tensile strength 55,000 to 130,000 lbs. per sq. in.; recommended heat treatment, annealing, 1100 to 1300 deg. Fahr.; brinell hardness, untreated, 70 to 200; used for condenser tubes and heat exchanger tubes.

- 2 - - - - - 7 - -

ADVANCE—Driver-Harris Co., Harrison, N. J. Copper 55, nickel 45; resists heat up to 1500 degrees Fahr.; thermocouple material. For application where low temperature coefficient of resistivity is required; also for measuring instruments, industrial and radio rheostats and elevator controls.

- - - - 4 - 6 - - -

AERISWELD—Lincoln Electric Co., Cleveland; arc-welding electrode; for welding of bronze, brass and copper either in manufacturing or maintenance work.

1 2 - - - 6 - - - -

AGRICOLA—Saginaw Bearing Co., Saginaw, Mich.; a bearing bronze of copper 70, lead 30; impurities less than .2 of 1; resists corrosion caused by acids; resists heat to 500 degrees Fahr.; ductility medium; especially adapted for diesel engine bearings and airplane bearings.

1 - - 4 - - 7 - - -

ALBRO METAL—Bronze Die Casting Co., Pittsburgh. Approximately 90 copper, 9 aluminum and 1 iron; furnished in rough bars or billets, finished rods or bars, and plates; for sand castings, die castings and hot forging; resists corrosion due to sulphuric acid and heat up to 1600 degrees Fahr.; tensile strength, ult., 89,000 lbs. per sq. in., (extruded); medium ductility; specific gravity, 7.43; brinell hardness, untreated 130, heat treated 220; for use as bolts, nuts, rivets, cocks, valves, sprocket chains and clevices.

1 - - 4 5 - - - - 9

ALCOA—Aluminum Co. of America, Pittsburgh. Aluminum wrought and casting alloys in following grades:

1 - - - 5 - - - 9

Grade 3S-¼H; manganese 1.25, balance aluminum plus normal impurities; finished rods or bars, tubing, wire, sheets, strips and plates, for stamping, extruding, welding, spinning, riveting, drawing, etc. Resists corrosion caused by all atmospheres, sea water, numerous chemicals; melts at 1250 Fahr.; tensile strength, ult., 18,000 lbs. per sq. in.; ductility, high; bearing properties, fair; nonmagnetic; weldability, good. Used for low-stressed parts where high workability and resistance to corrosion are required.

1 - - - - - - - - 9

Grade 4S-½H; manganese 1.25, magnesium 1, balance aluminum plus normal impurities; sheets and plates, for stamping, welding, riveting, boring, etc. Resists corrosion caused by most atmospheres, food and petroleum products; tensile strength, ult., 34,000 lbs. per sq. in.; medium ductility; fair bearing properties; nonmagnetic. Used where moderately high strength, good corrosion resistance and bearing properties are required.

- - - - - - - - - 9

Grade 11S-T3; copper 5.5, lead .5, bismuth .5, balance aluminum plus usual impurities; finished rods or bars, wire and forgings, for turning, boring, etc. Resists corrosion caused by mild industrial atmospheres; not recommended for use above 250 Fahr. Tensile strength, ult., 49,000 lbs. per sq. in.; medium ductility; fair bearing properties; nonmagnetic; specific gravity 2.82. A free-machining alloy for automatic screw machine work where moderately high strengths and fair resistance to corrosion are required.

1 - - 4 - - - - - 9

Grade 17S-T; copper 4, manganese .5, magnesium .5, balance aluminum plus usual impurities; finished rods or bars, tubing, wire, strips, plates, forgings, extruded and rolled shapes, for stamping, turning, riveting, hot forging, etc. Resists corrosion caused by industrial atmospheres; not recommended for use above 250 Fahr. Abrasion resistance, medium; tensile strength, ult., 60,000 lbs. per sq. in.; medium ductility; specific gravity 2.79; fair bearing properties; nonmagnetic. Used where high strength, moderately high resistance to corrosion and fair machinability are required.

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Grade 52S-½H; magnesium 2.5, chromium .25, balance aluminum and usual impurities; finished rods or bars, tubing, wire, sheets, strips and plates, for stamping, welding, riveting, turning, etc. Resists corrosion caused by all atmospheres; melts at 1250 Fahr., softens at 650 Fahr.; tensile strength, ult., 37,000 lbs. per sq. in.; medium abrasion resistance and ductility; specific gravity 2.67; fair bearing properties; weldability, fair; nonmagnetic. Used for parts in which high resistance to corrosion combined with moderate strength is required.

Grade 53S-T; magnesium 1.3, silicon .7, chromium .25, balance aluminum plus usual impurities; finished rods or bars, tubing, wire, sheets, strips, plates, forgings and rolled and extruded shapes, for stamping, hot forging, welding, riveting, turning, etc. Resists corrosion caused by all atmospheres; melts at 1250 Fahr., softens at 400-650 Fahr.; tensile strength, ult., 39,000 lbs. per sq. in.; ductility, medium; specific gravity 2.69; bearing properties, fair; nonmagnetic. Used where high resistance to corrosion and moderately high strength and workability are required.

Grade 61S-T; magnesium .95, silicon .55, copper .25, chromium .25, balance aluminum plus usual impurities; tubing, sheets, plates and extrusions, for stamping, turning, boring, welding, riveting, spinning, drawing, etc. Corrosion resistant; melts at 1250 Fahr., softens at 650 Fahr.; medium abrasion resistant; tensile strength, ult., 45,000 lbs. per sq. in.; specific gravity 2.7; nonmagnetic. Used where moderate strength, good workability (forming) and fair machinability are required.

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Grade 13; silicon 12, balance aluminum; furnished as castings; resists corrosion caused by industrial and sea coast atmosphere; melts at 1250 Fahr.; medium abrasion resistance; tensile strength, ult., 33,000 lbs. per sq. in.; specific gravity 2.66; fair bearing properties; nonmagnetic; weldability, good. For control and instrument cases, small frames and housings, nameplates, covers, conveyor links, etc.

Grade 43 (also known as Lynite 43); silicon 5, balance aluminum; furnished as castings; resists corrosion caused by industrial and sea coast atmosphere; melts at 1250 Fahr., medium abrasion resistance; tensile strength, ult., 17,000 lbs. per sq. in. for sand castings, and 21,000 lbs. per sq. in. for permanent mold castings; medium ductility; specific gravity 2.67; nonmagnetic; brinell hardness, untreated, 40. Used for control and instrument cases, nameplates, covers, splash guards, housings, etc.

Grades 112 and 113 (also known as Lynite 112 and 113); copper 7.5, iron 1.2, silicon 4 max., zinc 2 max., balance aluminum; furnished as castings—No. 112 for sand casting and No. 113 for permanent mold castings. Resist corrosion caused by industrial atmospheres, melt at 1250 Fahr.; medium abrasion resistance; tensile strength, ult., 19,000 lbs. per sq. in., min., for sand castings and 24,000 lbs. per sq. in., min., for

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

permanent mold castings; compressive strength, ult., 62,000 and 70,000 lbs. per sq. in., respectively; specific gravity 2.86; fair bearing properties; nonmagnetic; brinell hardness 70-80 untreated. Used for gear cases, covers, bases, handwheels, small housings and other parts not subject to high stresses or impact.

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Grades 195 and B195 (also known as Lynite 195 and B195). No. 195: copper 4, balance aluminum; No. B195: copper 4.5, silicon 3, balance aluminum. Both grades furnished as castings: No. 195 for sand casting and No. B195 for permanent mold casting; corrosion resistant; melt at 1250 Fahr.; medium abrasion resistance; tensile strength, ult., 29,000-36,000 lbs. per sq. in. for sand casting and 32,000-35,000 lbs. per sq. in. min., for permanent mold casting; compressive strength, ult., 77,000-85,000 lbs. per sq. in.; high ductility; specific gravity 2.77; bearing properties, fair; nonmagnetic; brinell hardness, heat-treated, 65-95. Used for turrets, shaper rams and links, boring machine heads, planer tables, head and tail stocks, control levers, etc.

Grade 356 (also known as Lynite 356); silicon 7, magnesium .3, balance, aluminum; furnished as castings; corrosion resistant; melts at 1250 Fahr.; medium abrasion resistance; tensile strength, ult., 23,000-30,000 lbs. per sq. in., for sand castings; 28,000-32,000 lbs. per sq. in., min., for permanent mold castings; compressive strength, ult., 80,000-87,000 lbs. per sq. in.; medium ductility; specific gravity 2.65; bearing properties, fair; nonmagnetic; brinell hardness, heat treated, 55-85. Used for pneumatic and hydraulic cylinders for presses, chucks and other intricate castings.

Grade 14S (also known as Lynite 14S); copper 4.4, silicon .8, manganese .8, magnesium .4, balance aluminum; furnished as forgings; corrosion resistant; melts at 1250 Fahr.; medium abrasion resistance; tensile strength, ult., 65,000 lbs. per sq. in., min.; compressive strength, ult., 65,000 lbs per sq. in.; ductility, medium; specific gravity 2.8; nonmagnetic; brinell hardness, heat treated, 130 min. Used for connecting rods and reciprocating linkage, ball cranks, hand levers, and other parts where maximum strength is required.

Grade A 51S (also known as Lynite A 51S); silicon 1, magnesium .6, chromium .25, balance aluminum; furnished as forgings; corrosion resistant; melts at about 1250; medium abrasion resistance; tensile strength, ult., 44,000 lbs. per sq. in., min.; specific gravity 2.69; nonmagnetic; weldability, good; brinell hardness, heat treated, 90 min. Used for control levers, bell cranks, reciprocating linkage, pneumatic cylinders and pistons, small gears, etc.

Lynite: Aluminum wrought and casting alloys in the following grades: Nos. 43, 112, 113, 195, B195, 356, 14S, and A51S. This material is also designated by the tradename Alcoa, and the foregoing grades are described in full under that tradename.

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ALCUMITE—Duriron Co. Inc., Dayton, O. Copper 90, aluminum 9, iron 1; for pumps, valves, pipe, fittings, bars and castings for corrosive service where a copper base alloy is preferred.

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ALLEGHENY—Allegheny-Ludlum Steel Corp., Pittsburgh.

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18-8; carbon .08 to .20, phosphorus .025 max., sulphur .025 max., silicon .50 max., manganese .50 max., chromium 17.5 to 19, nickel 8 to 9; used for dairy and food processing equipment, automobile trim, chemical plant, household and kitchen accessories.

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Stainless 12 type 410; ("to be heat treated to specific physical properties"); also available in Stainless 12-TB type 403 (turbine quality), 12-NH type 405 (nonhardening quality), Stainless 12-EZ type 416 (free machining), and Stainless 12-W type 418. Carbon .12 max., manganese .50 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 10 to 13.5; resists temperatures up to 1500 degrees Fahr.; used for automotive parts, combustion and steam engine parts, chemical plant equipment tanks, fans, blowers and furnace parts.

Stainless 46 types 501 and 502; carbon .10 max., manganese .50 max., phosphorus .04 max., sulphur .04 max., silicon .50 max., chromium 4 to 6; following elements may be added for increased resistance to oxidation and for improved mechanical properties: Molybdenum .40 to .60, tungsten .75 to 1.25, copper 0.5 to 1; for nonhardening characteristics aluminum .10 to .25, titanium or columbium ten times carbon per cent; adaptable for wide range of uses in the oil industry.

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Stainless 28 type 446; carbon .25 max., manganese 1.00 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 23 to 30; for high temperature service up to 2150 degrees Fahr., used for furnace parts, boiler baffles, kiln lining, pyrometer protection tube, glass molds, oil still tube supports, etc.

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Stainless 17 type 430; also available in modified form in Stainless 17W type 438, containing tungsten, Stainless 21 type 442, containing 18 to 23 chrome. Carbon max. .12, manganese max. .50, phosphorus max. .025, sulphur max. .025, silicon max. .50, chrominum 14 to 18; resists oxidation to temperatures up to 1600 degrees Fahr.; used for steel engine parts, low temperature furnace parts, fans and blowers, evaporators and chemical plant equipment.

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25-12 type 309; carbon .20 max., manganese 1.25 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 22 to 26, nickel 12 to 14; resists scaling at temperatures up to 2000 degrees Fahr.; malleable and ductile; used for furnace parts, industrial ovens, kiln linings, still tube supports and pump parts.

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ALLEGHENY LUDLUM — Allegheny-Ludlum Steel Corp., Pittsburgh.

"4750"; furnished in rods, sheets, coiled strips and laminations for stamping, forming and drawing. Nickel 47 to 50, balance iron. Has very high permeability when dry hydrogen-annealed after fabrication; recommended heat treatments, 1800 to 2000 degrees Fahr. in dry hydrogen; used in audio transformers, sensitive relays and electrical instruments.

88; furnished in rods, sheets and plates for stamping, boring and welding. Nickel, 12 to 14; manganese, 5 to 7; balance, iron. Is nonmagnetic whether hard-worked or soft-annealed. Weldability, fair; recommended heat treatment, 1400 to 1475 degrees Fahr. Used where strength is required combined with nonmagnetic properties.

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Electrical steels furnished in sheets and coiled strips for stamping; ½ to 4½ per cent silicon according to requirements. Has magnetic and electrical properties, high permeability; high electrical resistance; nonaging; good surface insulation; fair weldability; recommended heat treatment, 1400 to 1450 degrees Fahr.; used for motor laminations.

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Relay steels furnished in rods or bars for turning, boring, etc.; 1 to 2½ per cent silicon. Has magnetic properties, high permeability; nonaging; electrical properties; low retentivity, low coercive force; weldability fair; recommended heat treatment, 1500 to 1550 degrees Fahr.; used for magnetic relays and solenoids.

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ALLEGHENY METAL—Allegheny-Ludlum Steel Corp., Pittsburgh.

18-8-S; stainless type 304; carbon .08 max., manganese .50 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 17.5 to 19 and nickel 8 to 9.

19-9; stainless type 305; carbon .08 to .20, manganese .50 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 18 to 20 and nickel 9 to 10.

19-9-S; stainless type 306; carbon .08 max., manganese .50 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 18 to 20 and nickel 9 to 10.

18-8; stainless type 302; carbon over .08 to .20, manganese .50 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 17.5 to 19 and nickel 8 to 9.

18-8EZ (free-machining quality); stainless type 303; carbon .08 to .20, manganese .20 to 1.20, phosphorus .17 max., sulphur .60 max., silicon .70 max., chromium 17.5 to 19 and nickel 8 to 9.

20-10; stainless type 307; carbon .08 to .20; manganese .50 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 20 to 22, and nickel 10 to 12.

20-10-S; stainless type 308; carbon .08 max., manganese .50 max., phosphorus .025 max., sulphur .025 max., silicon .50 max., chromium 20 to 22 and nickel 10 to 12.

Where fabrication requires deep drawing, welding or severe cold work, Allegheny Metal 19-9 will be found superior in most cases to Allegheny Metal 18-8-S because it has less tendency to work harden and requires much more cold work to make it magnetic. Its combined chromium and nickel insures greater stability than that of Allegheny Metal 18-8-S after short time heating such as in the welding operation. The higher carbon content also produces an alloy with higher true proportional limit and tensile strength giving greater resistance to reverse bending stresses thereby reducing the tendency for fatigue failure.

When special conditions of service justify the use of Allegheny Metal with additions of columbium, molybdenum, titanium, vanadium, or other elements, such modifications will be made.

Foregoing metals used for food, dairy, chemical and household equipment, and for railroad and automotive industries.

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ALLOY No. 10—Hevi Duty Electric Co., Milwaukee. Chromium 37.5, aluminum 7.5, iron 55; for resistor elements in heat treating furnaces at temperatures of 2300 to 2400 degrees Fahr. Licensees: Hoskins Mfg. Co., Detroit, Mich.

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ALNICO—General Electric Co., Schenectady, N. Y.; Simonds Saw & Steel Co., Lockport, N. Y.; Taylor-Wharton Iron & Steel Co., High Bridge, N. J. Permanent magnet alloy of high coercive force; nickel 20 to 30 per cent, aluminum 10 to 12, cobalt 3 to 5, balance iron; extremely hard and obtainable in cast form. Licensees include: Continental Motors Corp., Detroit, and Arnold Engineering Co., Chicago.

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ALUMINWELD—Lincoln Electric Co., Cleveland. A 5 per cent silicon-aluminum-alloy electrode for arc welding aluminum in any form—cast, sheet, shapes, or extruded forms. For either metallic or carbon arc welding. Welds are very dense without porosity and possess high tensile strength.

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AMBRAC—American Brass Co., Waterbury, Conn. Grade A; copper 75, zinc 5, nickel 20; used for condenser tubes, etc.

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AMBRALOY—American Brass Co., Waterbury, Conn. Aluminum brass alloys for varied special uses, particularly condenser tubes.

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AMERICAN BONDED METALS — American Nickeloid Co., Peru, Ill. Chromium, nickel, brass, copper, gold resemblance and colors bonded to base metals such as steel, tinplate, zinc, brass, copper, aluminum and nickel silver. Available in brilliant finishes and patterns as sheets, flat strips, coiled strip and round edge flat wire. Can be supplied with gum adhered paper covering protecting prefinish in drawing and forming. For parts and trim of coin-operated phonographs, vending and game machines, toys, dispensers, hardware specialties, stoves, refrigerators, automobiles, radios, washing machines, etc.

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AMPCOLOY—Ampco Metal Inc., Milwaukee. Various grades of copper-base alloys.

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Grade E-1; copper 89, aluminum 10, iron 1; furnished in rough bars or billets, rods or bars, for sand casting, hot forging, extruding, turning, boring, and as centrifugal castings. Resists corrosion caused by acids and other corrosives; resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, ult., 70,000 to 80,000 lbs. per sq. in.; compressive strength, ult., 136,000 lbs. per sq. in.; ductility, high;

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

specific gravity, 7.48; bearing properties, good; nonmagnetic; used for gears, pickling equipment, bearings, screw down nuts.

1 - - 4 5 - - - -

Grade A-3; same analysis as E-1; furnished in rough bars or billets, finished rods or bars and plates, for sand casting, hot forging, turning, boring, and as centrifugal castings. Resists corrosion caused by acids and other corrosives; resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, 75,000 lbs. per sq. in.; compressive strength, ult., 135,000 lbs. per sq. in.; ductility, high; bearing properties, good; nonmagnetic; weldability, good; brinell hardness, untreated, 120; for gears, forgings, bushings, bearings, and pressure parts.

- - - 4 5 6 - - -

Grade E-133; same analysis as E-1; furnished in rough bars or billets and finished rods and bars, for sand casting, hot forging, turning, boring, and as centrifugal castings. Resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, ult., 90,000 lbs. per sq. in.; compressive strength, ult., 145,000 lbs. per sq. in.; ductility, medium; specific gravity, 7.48; bearing properties, good; nonmagnetic; weldability, fair; used for gears, worm wheels, feed nuts and bearings.

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Grade A-323; same analysis as E-1; furnished in rough bars or billets, finished rods or bars and plates, for sand casting, hot forging, turning, boring, and as centrifugal castings. Resists corrosion caused by mild corrosives; resists heat to 1000 degrees Fahr.; medium abrasion resistant; tensile strength, ult., 85,000 lbs. per sq. in.; compressive strength, ult., 136,000 lbs. per sq. in.; ductility, high; specific gravity, 7; bearing properties, good; nonmagnetic; weldability, good; used for gears, bushings, bearings, sleeves and forks.

See advertisement, Page 3-D

1 - 3 4 5 6 - - -

AMPCO METAL—Ampco Metal Inc., Milwaukee. Special copper-base alloys for wear and corrosion-resistant service; produced in six grades. Licensee: Wellman Bronze & Aluminum Co., Cleveland.

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Grade 12; copper 88.2, aluminum 8.6, iron 2.9, others .3; furnished in rods, bars, sheets, and plates, for hot forging, turning, boring and welding; also as sand or centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; low abrasion resistance; tensile strength 65,000 lbs. per sq. in.; compressive strength 120,000 lbs. per sq. in.; high ductility; specific gravity 7.735; good bearing properties; nonmagnetic; brinell hardness 115; for use as bushings and bearings.

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Grade 16; copper 86.2, aluminum 10.2, iron 3.3, others 0.3; furnished in rods, bars, sheets and plates for hot forging, turning, boring and welding; also as sand or centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; medium abrasion resistance; tensile strength, 75,000 lbs. per sq. in.; compressive strength, 125,000 lbs. per sq. in.; high ductility; specific gravity 7.628; good bearing properties; nonmagnetic; fair weldability; brinell hardness, heat treated, 137; used for bearings, gears, worm-wheels, liners, lead screw nuts—all for heavy duty where exceptional resistance to wear is required.

1 - - 4 - 6 - - -

Grade 18; copper 84.6, aluminum 11.3, iron 3.2, others 0.4; furnished in rods, bars, sheets and plates, for hot forging, turning, boring and welding; also as sand or centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; tensile strength 80,000 to 85,000 lbs. per sq. in.; compressive strength 136,000 lbs. per sq. in.; medium ductility; good bearing properties; nonmagnetic; brinell hardness, heat treated, 173; for use as heavy-duty, wear-resistant gears, worm-wheels, feed nuts, bearings, welding bases and pickling equipment.

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Grade 20; copper 83.13, aluminum 12.40, iron 4.07, and others 0.4; available as sand and centrifugal castings; corrosion resistant; resists heat to 1000 degrees Fahr.; high abrasion resistance; tensile strength 85,000 lbs. per sq. in.; compressive strength 146,000 lbs. per sq. in.; specific gravity 7.437; good bearing properties; nonmagnetic; brinell hardness, untreated, 241; for use as cams and cam rollers, welding jaws, bushings, bearings, and other wear resistant parts.

- - 3 4 - 6 - - -

Grade 21; copper 82.34, aluminum 13.02, iron 4.14, others 0.5; available as sand and centrifugal castings; resists heat to 1000 degrees Fahr.; high abrasion resistance; tensile strength, ult., 90,000 lbs. per sq. in.; compressive strength, ult., 160,000 lbs. per sq. in.; ductility, low; specific gravity, 7.152; fair bearing properties; nonmagnetic, brinell hardness, untreated, 311; for use as forming and drawing dies, bushings and bearings replacing hardened steel.

- - 3 4 - 6 - - -

Grade 22; copper 81.67, aluminum 13.42, iron 4.41, others .50; available as sand and centrifugal castings; resists heat to 1000 degrees Fahr.; high abrasion resistance; tensile strength 90,000 lbs. per sq. in.; compressive strength 171,000 lbs. per sq. in.; low ductility; specific gravity 7.125; fair bearing properties; nonmagnetic; brinell hardness, untreated, 335; for use as forming and drawing dies.

See advertisement, Page 3-D

1 2 3 4 5 - - 8 -

AMSCO—American Manganese Steel Div., The American Brake Shoe & Foundry Co., Chicago Heights, Ill.

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Manganese steel; 10 to 14 manganese, 1 to 1.40 carbon, balance iron; suitable for sand casting; for power shovel dippers and teeth, rock crusher parts, dredge pumps, etc.

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Alloy F-1; 15 to 17 chromium, 34 to 36 nickel; for conveyor chain, enameling furnace supports, burner parts etc.; heat resistant to 2100 degrees Fahr.; creep resistant at high temperatures.

F-3; 27 to 29 chromium, 0 to 3 nickel; for rabble arms and blades, sintering bars, etc.; heat resistant to 1800 degrees Fahr. where temperature changes are not wide and where high unit strength is not essential.

F-5; 17 to 19 chromium, 65 to 68 nickel; furnace conveyor pans, heat treating boxes, enameling fixtures, etc.; similar properties to F-1 and F-6, except tougher and more resistant to temperature fluctuations.

F-6; 12 to 14 chromium, 59 to 62 nickel; for heat treating boxes, retorts, etc.

F-8; 20 to 22 chromium, 8 to 10 nickel; for mine water and acid pump parts, marine fittings, chemical mixer and paper mill digester parts.

F-10; 26 to 28 chromium, 10 to 12 nickel; for heat treating furnace shafts, dampers and valves, cement kiln cooler parts, etc.; creep resistant at high temperatures.

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Nickel-manganese steel; 13 to 15 manganese, .70 to .90 carbon, .95 to 1.20 silicon, 3.50 to 4.50 nickel; welding rod for building up austenitic manganese steel castings.

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No. 459; chromium molybdenum hard alloy welding rod for hard surfacing machinery wearing parts; deposits are 500 to 600 brinell.

No. 217; welding rod for hard facing cast wearing parts; extreme hardness and great wear resistance.

- 2 3 - - - - - -

Dieweld; a chrome-molybdenum welding rod for building up forming dies, cutting tools, punches, shear knives, etc.

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Economy hardface; self-hardening, chrome-molybdenum-high carbon welding rod manufactured bare for oxy-acetylene deposition; used for applications where extreme impact and abrasion are encountered.

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ANACONDA—American Brass Co., Waterbury, Conn.

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Beryllium Copper; copper 97.75, beryllium 2.25, nickel 0.25; for springs, diaphragms, low duty bushings and bearings.

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"85" Red Brass; copper 85, zinc 15; pipe tube and sheet forms; particularly resistant to salt water corrosion.

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Super-Nickel; copper 70, nickel 30; seamless tubes, sheets and plates; for severe condenser tube service and resistance to salt water corrosion.

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Special Phosphor Bronze; copper 88, tin 4, zinc 4, lead 4; combines general characteristics of standard phosphor bronze alloys with free cutting qualities of yellow brass.

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ANFRILOY—Wellman Bronze & Aluminum Co., Cleveland. A copper-lead-tin bearing bronze for high speed, light-duty bearings and for bushings where pressure and thrust are not excessive.

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ANTIMONIAL ADMIRALTY—Chase Brass & Copper Co. Inc., Waterbury, Conn. Copper 71, tin 1, antimony .07, zinc 27.93. Outstanding for general corrosion resistance and particularly for preventing dezincification. Recommended for condensers in the power plant and oil industries.

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APEX—Apex Smelting Co., Chicago. Zinc base die casting alloys furnished in ingots. Also aluminum alloys.

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APOLLOY METAL—Apollo Steel Co., Apollo, Pa. Carbon .08, manganese .40, sulphur .025, phosphorus under .045, copper .25 per cent; in sheets.

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ARMCO—American Rolling Mill Co., Middletown, O.

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Stainless steel, grade 18-8 (type 302, 304); 19-9 (type 305, 306); 18-12 (type 316); 25-12 (type 309); 17 (type 430); RA (type 434A); 13 (type 410); 17-7 (type 301X) and 27 (type 446); these can all be drawn and stamped; all machinable and weldable.

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Armco H. T.-50; high tensile steel; low carbon-nickel-phosphorus steel containing molybdenum. Supplied in sheets, strips and plates; suitable for stamping and welding.

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Tran-Cor 60; high silicon steel for distribution transformers. Grade 66; steel sheets with low core loss, for power and distribution transformers. Grade 72; a high silicon steel for large generators and general transformer work.

Intermediate Transformer; scale-free silicon steel sheet for some transformer and special applications.

Special Electric; scale-free medium steel sheet for a.c. motors and generators.

Electric; special analysis sheet for rotating machines.

Armature; steel sheet for small d.c. motors.

Field Grade; special sheet for intermittent duty fractional horsepower motors.

Radio No. 6; for applications in which superior low induction magnetic characteristics are important. No. 5; for audio transformer cores and other low induction applications. No. 4; good permeability at low induction; for chokes. Nos. 3, 2 and 1; for small transformers.

Ingot Iron; highly refined iron for magnetic cores; supplied in round and flat bar form.

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Armco Ingot Iron; highly refined iron supplied in galvanized sheet for general sheet metal work; also hot rolled annealed and cold rolled sheets, plates and strip.

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Armco Enameling Iron; highly refined iron for enameling purposes; supplied in sheets.

- 2 - 4 - 6 - - -

ASARCOLOY No. 7—American Smelting & Refining Co., New York. A cadmium-nickel bearing alloy capable of withstanding high compression loads and high operating temperatures. Nickel 1.3, balance cadmium. Furnished in ingots for spinning and permanent mold castings. Resists heat to 300 degrees Fahr.; high abrasion resistance; tensile strength, ult., 15,000 lbs. per sq. in.; compressive strength, ult., 20,000 lbs. per sq. in.; specific gravity, 8.7; bearing properties, good; weldability, good; brinell hardness, untreated 33; used for bearings.

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

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ATLAS No. 93—Allegheny-Ludlum Steel Corp., Pittsburgh Carbon, .55, chromium .65, molybdenum .35; for collets, studs and parts requiring toughness in hardened condition. Oil hardening.

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AUROMET—Aurora Metal Co., Aurora, Ill. Special aluminum and silicon bronzes of several compositions.

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AVIALITE—American Brass Co., Waterbury, Conn. Copper-aluminum alloy for valve seats and guides in airplane motors.

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"AW" (rolled steel floor plate)—Alan Wood Steel Co., Conshohocken, Pa. Furnished in five patterns to meet flooring problems in the industrial and transportation fields; designed to withstand heaviest traffic; oilproof, crackproof, heatproof, slipproof, and noiseless. Furnished in carbon, copper or alloy analysis; also available in other nonferrous metals.

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"AW" DYN-EL—Alan Wood Steel Co., Conshohocken, Pa. High strength steel furnished in sheets, plates and floor plates; corrosion, high fatigue and impact values; carbon .12, manganese .60, phosphorus .085, sulphur .03, and copper .40; weldable; high tensile strength; for use in railroad equipment, trucks, buses and other automotive equipment and stationary structures.

B

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B.D. METAL—Bronze Die Casting Co., Pittsburgh. Nickel 70, copper 30; furnished as sand castings; resists corrosion caused by accelerated acid; tensile strength, ult., 60,000 lbs. per sq. in.; brinell hardness, untreated 140; used for steam jets.

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B & W CROLOY—Babcock & Wilcox Tube Co., Beaver Falls, Pa.

2; carbon .15 max., chromium 1.75-2.25, molybdenum .45-.65, silicon .50 max.; for refinery and superheater tubes. Corrosion resistant and heat resistant at nominal temperatures.

2¼; carbon .15 max., chromium 2-2.5, molybdenum .9-1.10, silicon .50 max.; for refinery and superheater tubes where exceptionally high creep strength is required.

5; chromium molybdenum; carbon .15 and .20 max., chromium 4-6, molybdenum .45-.65; for oil refinery service.

9; carbon .15 max., chromium 8-10, molybdenum 1.20 min.; semistainless alloy of good physical properties and corrosion resistance.

18; carbon .12 max., chromium .15-.18; useful for certain elevated temperature applications but particularly for nitric acid plant equipment.

18-8S; carbon .07 max., chromium 17-19, nickel 8-10; low carbon; for high temperature work or corrosion resistant service.

16-13-3; carbon .13 max., manganese 1.5 max., chromium 15.5-17, nickel 12.5-14.5, molybdenum 2.5-3.25; (modified 18-8S Mo.) austenitic type alloy similar in many respects to 18-8S and 25-20; high strength at elevated temperatures; corrosion resistant.

25-20; chromium 25, nickel 20; has high strength and high oxidation resistance; also excellent corrosion resistance.

12; carbon .12 max., chromium 12-14; resistant to atmosphere and acids; resists heat to 1500 degrees Fahr., and when heat treated has tensile strength of 180,000 lbs. per sq. in.; supplied in form of tubing.

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BAKER—Baker & Co. Inc., Newark, N. J. Platinum and alloys for linings, contacts, thermocouples, furnace resistors, etc.

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BEARITE—A. W. Cadman Mfg. Co., Pittsburgh; babbitt metal furnished in ingots and 50-pound pigs; brinell hardness at 70 degrees Fahr. 29.1, 212 degrees Fahr. 24.4; compressive strength 15,000 lbs. per sq. in.; for rotary bearings subjected to heavy loads and extreme speed.

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BEARIUM—Bearium Metals Corp., Rochester, N. Y.

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B-4 bearing metal; copper 70, tin 4, bearium-processed lead 26; brinell hardness 40; unusual frictional qualities; particularly suitable for bearing services not provided with ample lubrication, where loads are light and speeds high; resists corrosion; resists heat to 700 degrees Fahr.; tensile strength 21,500 lbs. per sq. in.; compressive strength 9750; for bearings and slides, guides, driving nuts, piston rings and packing rings.

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B-10 high strength bearing metal; copper 70, tin 10, bearium-processed lead 20; brinell hardness 55; for ordinary bearing services, including applications involving shock loading; resists corrosion due to high lead content; withstands heat to 700 degrees Fahr.; tensile strength 25,500 lbs. per sq. in.; compressive strength 11,800; a nonseizing, nonscoring, long life, general purpose bearing metal.

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BECKETT METAL—Beckett Bronze Co., Muncie, Ind. Several grades of high lead bronze; copper 60 to 75, tin 3 to 9, lead 16 to 35, and nickel 0 to 1; furnished in rough bars and rods (cored or solid) for turning, boring, etc.; resists corrosion due to sulphuric-hydrochloric acid solutions, and resistant to heat to 400 deg. Fahr.; tensile strength 21,000 to 24,000 lbs. per sq. in.; good bearing properties; brinell hardness, untreated, 36 to 46; used for bearings and to a limited extent in seals, piston rings and gears.

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BELMALLOY—Belle City Malleable Iron Co., Racine, Wis. Pearlitic malleable iron, electric furnace melted and continuous oven annealed; for castings of machining quality requiring strength and shock resistance.

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BETHADUR—Bethlehem Steel Co., Bethlehem, Pa. Steels of the designated characteristics for virtually all purposes except those calling for free machining. This tradename covers 43 different corrosion resistant alloying steels adaptable for machinery in the chemical industries, oil refining, mining and metallurgy, the paper industry, the food industry, etc. The following are typical examples:

No. 302; 17.5-19 chromium, 8-9 nickel, .08-.20 carbon.

No. 304; 17.5-19 chromium, 8-9 nickel, .08 max. carbon.

No. 305; 18-20 chromium, 9-10 nickel, .08-.2 carbon.

No. 306; 18-20 chromium, 9-10 nickel, .08 max. carbon.

No. 307; 20-22 chromium, 10-12 nickel, .08-.2 carbon.

No. 308; 20-22 chromium, 10-12 nickel, .08 max. carbon.

No. 403; 11.5-13 chromium, .12 max. carbon (turbine blading).

No. 410; 10-13.5 chromium, .12 max. carbon.

No. 420; 12-14 chromium, .12 min. carbon.

No. 430; 14-18 chromium, .12 max. carbon.

No. 440; 14-18 chromium, .12 min. carbon.

No. 442; 18-23 chromium, .35 max. carbon.

No. 446; 23-30 chromium, .35 max. carbon.

No. 501; 4-6 chromium, .10 min. carbon.

No. 502; 4-6 chromium, .10 min. carbon.

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BETHALON—Bethlehem Steel Co., Bethlehem, Pa. Free-machining, high chromium steel for variety of machine parts. Two typical grades are the following:

No. 303; 17.5-19 chromium, 8-9 nickel, .20 max. carbon, .15 min. or .60 max. sulphur or selenium.

No. 416; 12-14 chromium, .12 max. carbon, .15 min. or .60 max. sulphur or selenium.

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BETH-CU-LOY—Bethlehem Steel Co., Bethlehem, Pa. A copper bearing steel resistant to atmospheric corrosion; for jackets, covers, machine guards, oil pans, etc.

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BETHLEHEM—Bethlehem Steel Co., Bethlehem, Pa.

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Nos. 235 and 300; abrasion resistant, high-carbon-manganese-silicon steels of 235 and 300 brinell respectively; for shovels, crushers, hoppers, scraper blades and conveyors.

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Nos. 6 and 7; nickel steels containing 35 and 40 per cent nickel respectively; have low coefficient of expansion; for scientific and measuring instruments and for control equipment.

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BETHLEHEM—Bethlehem Steel Co., Bethlehem, Pa.

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Bearing steels; high carbon steels in three grades, namely; "Standard" chromium steel, "H. T. W." chromium-vanadium steel, and "Moly" chromium-molybdenum steel. All grades are processed to meet requirements of bearings for automotive and industrial service. Other uses include injector parts for diesel engines.

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Magnet steels; high carbon steels with varying chromium content, up to 6 per cent. Permanent magnet No. 1, a 6 per cent tungsten steel; Cobaflux, a high cobalt steel used for magnets in meters, telephones, magnetos and other electrical equipment.

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BETHLEHEM 88-80—Bethlehem Steel Co., Bethlehem, Pa. Chromium molybdenum steel castings with high abrasion resistance for ball mill liners, rolls, tires, bottom plates, etc.

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BIRDSBORO—Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.

No. 26; high physical properties including high tensile strength; resists corrosion because of copper content; for dredge castings and other castings subject to high stress.

No. 30; resists corrosion due to its copper and .25 molybdenum content; recommended for dredge castings and other castings subject to high stress.

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BOHNALITE—Bohn Aluminum & Brass Corp., Detroit. Light alloy of which aluminum is the base; for forged connecting rods, cast cylinder heads, crankcases, transmission cases, and parts for vacuum cleaners, washing machines, shoe machinery, etc.

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BORIUM—Stoody Co., Whittier, Calif. Tungsten carbide metal used chiefly as inserts in rotary drilling tools as substitute for diamonds.

Tube Borium and Borod; made up of steel tubing containing fine particles of Borium; used as overlays on earth working equipment.

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BOUND BROOK—Bound Brook Oil-less Bearing Co., Bound Brook, N. J. Graphite and bronze bushings, bearings and washers.

See advertisement, Page 12-D

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BRASSOID—American Nickeloid Co., Peru, Ill. Brass bonded to zinc, latter serving as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum adhered paper covering permitting drawing and forming without marring pre-finish. For toys, machinery trim and nameplates, index and instruction plates, etc.

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BRIDGEPORT COPPER AND ZINC ALLOYS—Bridgeport Brass Co., Bridgeport, Conn.

Yellow brass; copper 65, zinc 35; sheet, wire and seamless tubing for drawing, stampings, and cold heading.

Free cutting brass rod; copper 60, lead 3, balance zinc; for making automatic screw machine parts.

Low brass; copper 80, zinc 20; pale golden color; for articles requiring greater duc-

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

ility and malleability than possessed by yellow brass.

commercial bronze; copper 90, zinc 10; bronze color for manufacturing stampings and drawn items and cold headed items, for outdoor use; stands weathering better than yellow brass; copper sheet, rod, wire, seamless tubing for miscellaneous manufacturing.

phosphor bronze; copper 92, tin 8; for spring parts; has better spring properties than 95 per cent and 5 per cent.

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phosphor bronze; copper 95, tin 5; sheet spring quality for manufacturing switch parts.

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CHASE 444 BRONZE—Chase Brass & Copper Co. Inc., Waterbury, Conn. Copper 88, tin 4, lead 4, zinc 4; a high-strength, free-machining, general purpose alloy particularly recommended for bushings and condenser tubes. For bushings it shows excellent resistance to wear, and for condenser tubes excellent resistance to corrosion from most types of water.

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BUFFLOKAST—Buffalo Foundry & Machine Co., Buffalo. Silicon 1 to 2, sulphur .07-.12, phosphorus .10-.40, manganese .60-1.25, carbon 2.90-3.80, nickel .50-3, chromium .5-2, molybdenum .5-1.50; furnished as sand castings; resists corrosion due to acids and alkalies; resists heat to 1800 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 30,000-60,000 lbs. per sq. in.; for chemical and vacuum drying machinery.

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BUNTING—Bunting Brass & Bronze Co., Toledo. A line of some 160 bearing bronzes available as fully-machined bar stock and ready-cut bushings, including the following:

Alloy No. 27; phosphor bronze (leaded) for bearings.

Alloy No. 51; for low speeds, heavy loads, gears; free-machining.

Alloy No. 72; general purpose bearing bronze; used in standard stock items.

Alloy No. 96; high strength, excellent machinability, low speeds, heavy loads.

Alloy No. 124; camshaft bearings, piston pin bearings, etc.

Alloy No. 125; high lead, low friction, scanty lubrication applications.

Alloy No. 135; for average bushing applications.

Alloy No. 156; hard gear bronze.

Alloy No. 164; nickel gear bronze, synchronizer cones.

Alloy No. 178; copper-lead precision type main and connecting rod bearings. Genuine Babbitt, tin base babbitt; high strength ingot material for bearings.

Babbitt; general all-purpose babbitt.

Precision; cored and solid fully-machined bar stock from dense grained bearing bronze.

See advertisement, Page 19-D

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CANNON 3½ PER CENT NICKEL STEEL—Cannon-Stein Steel Corp., Syracuse, N. Y.

S.A.E. 2315; carbon .15, manganese .45, phosphorus .04, sulphur .05, silicon .30, nickel .35; brinell hardness untreated 174; recommended heat treatment carburized at 1650 degrees Fahr., heat treated at 1450-1500 degrees Fahr. oil quenched. Resists corrosion due to nickel content; resists heat to 800-1000 degrees Fahr.; tensile strength 85,000 lbs. per sq. in. as rolled; for king pins, rock drill parts, air hammer parts, universal joints, bolts, shafts, studs, etc.

S.A.E. 2320; carbon .20, manganese .50, phosphorus .04, sulphur .05, silicon .03 max., nickel 3.50; brinell hardness untreated 174; recommended heat treatment carburized at 1650 degrees Fahr., heat treated at 1450-1500 degrees Fahr.; resists corrosion due to nickel content; resists heat to 800-1000 degrees Fahr.; tensile strength 90,000 lbs. per sq. in. as rolled; for uses same as S.A.E. 2315.

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CANNONITE—Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich. Electric furnace high test cast iron; for diesel and auto cylinders, centrifugal sleeves and brake drums, gas-tight castings, presses, dies, etc.

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CARBOLOY—Carboloy Co. Inc., Detroit. A series of cemented carbides embodying tungsten carbide, tungsten and tantalum carbides, tungsten and titanium carbide or combinations of these. Has high resistance to abrasive and corrosive wear; outstanding on account of its extreme hardness, compressive strength being as high as 890,000 lbs. per sq. in.; Rockwell hardness on "A" scale 87-92.5; does not rust or corrode under normal conditions. Recommended as wear resistant inserts for machine parts subject to extreme wear such as cams, cam followers, hydraulic valve stems and seats, machine tool rests, etc.

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CARBOMANG—Detroit Alloy Steel Co., Detroit. Furnished as castings. Carbon .90-1.00, manganese 1.00-1.10, chromium .40-.60; medium abrasion; tensile strength, ult., 125,000 lbs. per sq. in.; compressive strength, ult., 200,000 lbs. per sq. in.; medium ductility; brinell hardness, untreated 200, heat treated 600; for air-hardening tool steel castings.

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CARPENTER—The Carpenter Steel Co., Reading, Pa.

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Stainless No. 1 bar steel; carbon .1, chromium 12; for valve trim, turbine blades, heat-treated parts; also has high ductility.

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Stainless No. 2; carbon .3; chromium 13; used in fully hardened condition for ball bearings, ball check valves, cutlery, instruments, etc.

Stainless No. 2B; carbon 1, chromium 17; uses same as No. 2.

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Stainless No. 3; carbon .3, chromium 20, copper 1; for special chemical apparatus and scale resisting parts.

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Stainless No. 4; carbon .1, chromium 18, nickel 8; for rolled moldings, stampings, etc.; also has high ductility.

Stainless No. 5; carbon .1, chromium 14, sulphur .30; a free machining grade for automatic screw machine parts, valve trim, pump shafts, etc. Is heat resistant.

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Stainless No. 6; carbon .1, chromium 16 to 18; uses same as No. D-1 and No. 4.

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Stainless No. 8; carbon .1, chromium 18, nickel 8, selenium .25; a free machining grade; heat resistant.

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Chrome magnet steel; carbon .95, chromium 3.5; for magnets in meters and other electrical apparatus.

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Presto; carbon 1.05, chromium 1.4; for ball and roller bearings.

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Silico-manganese steel; carbon .6, manganese .75, silicon 2; for heavy duty springs.

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No. 5-317; chrome nickel steel; carbon .5, nickel 1.75, chromium 1; for gears, clutches and shafts.

No. 5 Samson; carbon .5, nickel 1.25, chromium .6; for gears and clutches.

No. 4-408; carbon .4, nickel 3, chromium .75; for clutches and shafts.

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No. 158; carbon .1, nickel 3.5, chromium 1.5; for case hardened high duty clash gears, shafts, clutch parts.

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No. 4 Samson steel; carbon .4, nickel 1.25, chromium .6; for side links of silent chains, shafts, axles, etc.

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No. 2 Samson; carbon .2, nickel 1.25, chromium .6; for case-hardened gears, roller bearings, pneumatic tool parts, etc.

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No. 3-547; nickel steel; carbon .3, nickel 3.5; for heat treated shafts, etc.

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No. 2-547; case hardening nickel steel; carbon .2, nickel 3.5; for small parts requiring hard surface and tough core.

No. 500; carbon .1, nickel 5; for turbine blades, case-hardened gears, etc.

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Chrome vanadium 5-720; carbon 5, chromium .9, vanadium .2; for leaf and coil springs, gears, shafts, etc.

No. 3-427 chrome molybdenum steel; carbon .3, chromium 1, molybdenum .2; for aircraft and automotive parts.

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No. 436; carbon .15, nickel 1.75, molybdenum .25; for case-hardened parts.

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CAST ALLOY STEEL—The Alloy Cast Steel Co., Marion, O.

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Nickel steel castings; carbon .30-.40, manganese .60-.80, sulphur .05 max., phosphorus .045 max., silicon .35-.45, nickel 3.25-3.75; has high strength and resistance to shock and fatigue; used largely in annealed condition, although responds to heat treatment.

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Nickel chrome steel castings; carbon .35-.45, manganese .60-.80, phosphorus .045 max., sulphur .05 max., silicon .35-.45, nickel 1.50-2.00, chromium .60-.75; has high strength and wear resistance.

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Nickel, chrome, molybdenum steel castings; carbon .35-.45, manganese .60-.80, phosphorus .045 max., sulphur .050 max., silicon .35-.45, nickel 1.50-2.00, chrome .60-.75, molybdenum .25-.45; used in parts which must be strong and hard and where size or shape prevent liquid quenching.

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Manganese molybdenum steel castings; carbon .30-.40, manganese 1.25-1.60, phosphorus .045 max., sulphur .050 max., silicon .35-.45, molybdenum .25-.45; used for gears, sprockets, levers, etc.

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Medium manganese steel castings; carbon .30-.40, manganese 1.25-1.50, phosphorus .045 max., sulphur .050 max., silicon .35-.45; used in power shovels, tractors, road machinery, etc.

High manganese steel castings; carbon 1.10-1.30, manganese 10.50-13.50, phosphorus .10 and under; tensile strength, 80,000-90,000; yield, 40,000-50,000; cannot be machined readily and is usually finished by grinding.

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CASTOLOY—Detroit Alloy Steel Co., Detroit. Furnished as castings. Chromium 12-14, carbon 1.5-1.6, cobalt .70, molybdenum .85; semiresistant; heat resistant to 1000 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 100,000 lbs. per sq. in.; compressive strength, ult., 350,000 lbs. per sq. in.; medium ductility; good bearing and magnetic properties; used for bearings, cams, valve seats and spindles.

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CECOLLOY — Chambersburg Engineering Co., Chambersburg, Pa.

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A; carbon 3.00; molybdenum .50, nickel .60; shock resistance, vibration damping, and close grain.

B; carbon 2.80, molybdenum .50, chromium .35; also has shock resistance, is vibration damping and has close grain in heavy sections.

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C; carbon 3.00, molybdenum .50, nickel 1.50; properties similar to type A.

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CECOLLOY IRON—Chambersburg Engineering Co., Chambersburg, Pa.; carbon 3, manganese .90, silicon 1.30, nickel 60, molybdenum .50; suitable for casting in cement-bonded sand molds; resists corrosion to atmospheric conditions and acids; has tensile strength 56,000 lbs. per sq. in.; brinell hardness of 255; for steam cylinder liners, cylinders, rings and valves; also beds for heavy duty machine tools.

CERROBASE—Cerro de Pasco Copper Corp., New York. Bismuth-lead casting alloy which expands on cooling; melts at 255 degrees Fahr.; tensile strength 6100 lbs. per sq. in.; recommended for master patterns, electroforming, engraving machine models, etc.

CERROBEND—Cerro de Pasco Copper Corp., New York. Bismuth-lead-tin-cadmium cast-

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

ing alloy which expands on cooling and has the extremely low melting temperature of 160 degrees Fahr.; tensile strength of 6000 lbs. per sq. in.; useful as a fusible alloy and as a filler for tube bending.

CERROMATRIX—Cerro de Pasco Copper Corp., New York. Bismuth-lead-tin-antimony casting alloy which melts at 248 degrees Fahr. and expands on cooling; tensile strength 13,000 lbs. per sq. in.; used for locating and anchoring machine parts in cored holes.

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CHACE THERMOSTATIC METAL—W. M. Chace Co., Detroit. Thermostatic bimetals; a number of combinations including alloys of nickel-iron, nickel-iron-chromium, nickel-iron-manganese, pure nickel, brass, bronze, etc.; responsive to various temperature ranges and provide a wide range of deflection rates and electrical resistivities; for temperature control elements in controllers, recorders, indicators, circuit breakers, etc.

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CHAMET BRONZE—Chase Brass & Copper Co. Inc., Waterbury, Conn. Copper 62, tin .65, zinc 37.35; for general use where relatively corrosion resistant brass is required.

Leaded; Copper 62, tin .65, lead 1.5, zinc 35.85; for forming of parts on automatic screw machines where a free-cutting relatively high-strength corrosion resistant brass is required.

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CHASE—Chase Brass & Copper Co. Inc., Waterbury, Conn.

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Admiralty Brass; copper 71, tin 1, zinc 28; standard alloy for condenser tubes, particularly for salt or brackish water.

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Cupro-Nickel; copper 70, nickel 30, and copper 80, nickel 20; largely used for condenser tubes particularly for extreme service in very corrosive waters.

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Free-cutting commercial bronze; copper 89, lead 2, zinc 9; for screw machine parts requiring good physical properties and high corrosion resistance.

Also various high and low brasses for a variety of mechanical parts.

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CHROMALOID—American Nickeloid Co., Peru, Ill. Chromium bonded to nickel-bonded zinc, latter serving as rustproof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum adhered paper covering permitting drawing and forming without marring pre-finish. For reflectors, automotive details, washing machine parts, and for other stamped and formed parts requiring brilliant, permanent finish.

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CHROMAX—Driver-Harris Co., Harrison, N. J. A heat resisting alloy used for carburizing containers or furnace parts; nickel 35, chromium 19, and balance iron.

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CHROMEL—Hoskins Mfg. Co., Detroit.

No. 502; 18½ chromium, 35 nickel, balance mainly iron; for burning tools in the enameling industry and for metal furnace parts.

No. 670; 23 to 28 chromium, 10 to 13 nickel, balance mainly iron; strongly resistant to sulphurous atmospheres.

Grade A; nickel 80, chromium 20; resists heat to 2200 Fahr.; high abrasion resistance, tensile strength, ult., 110,000 lbs. per sq. in.; for electric heating elements.

Grade B; nickel 80, chromium 20; corrosion and heat resistant; high abrasion resistance; tensile strength, ult., 110,000 lbs. per sq. in.; for heating elements.

Grade C; chromium 16, iron 23, balance nickel; corrosion and heat resistant; high abrasion resistance; tensile strength, ult., 105,000 lbs. per sq. in.; for heating elements and resistors.

Grade D; nickel 35, chromium 18½, balance iron; heat and corrosion resistant; high abrasion resistance; tensile strength, ult., 110,000 lbs. per sq. in.; for heating elements and resistors, and protection tubes.

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CHROMEWELD 4-6—Lincoln Electric Co., Cleveland. For the welding of steels commonly known as 5 per cent chromium steels. Annealed at 1550-1600 degrees Fahr.; cooled slowly and stress relieved at 1400 degrees Fahr. will have tensile strength of 80,000-90,000 lbs. per sq. in.; yield point 55,000-65,000 lbs. per sq. in.; elong. in 2 in., 24-30 per cent; reduction in area 60-70 per cent; brinell hardness, 155-175.

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CIMET—Driver-Harris Co., Harrison, N. J. Nickel 10-12, chromium 26-28, and balance iron; castings for furnace parts in high sulphur atmospheres, and for acid resisting castings in the form of pump impellers, piping, etc.

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CIRCLE L—Lebanon Steel Foundry, Lebanon, Pa. This tradename covers castings in forty-three different types of alloys including the following:

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No. 1; manganese 1.40, carbon .35, with vanadium or molybdenum.

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No. 2; carbon .32, chromium .75, molybdenum .30, manganese 1.40; for crankshafts, airplane parts, valves and other castings.

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No. 3; carbon .50, chromium 1.25, vanadium .12, molybdenum .40, manganese .75; for gears and cams.

No. 5; carbon .30, chromium .75, nickel 1.75, molybdenum .30; for highly stressed parts.

No. 6; carbon .5, nickel 1.75, molybdenum .25; for cams, gears and other case hardened parts.

No. 9; carbon .25, molybdenum .45; for parts subject to temperature.

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No. 10; carbon .20, chromium 5.50, molybdenum .55; for high pressure and high temperature applications in the oil industry.

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No. 11; carbon .25, chromium 18; hard stainless steel; for parts subject to nitric acid corrosion.

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No. 12; carbon .10, chromium 13; stainless steel; for chemical apparatus, etc.

No. 13; carbon .25, chromium 13; for stainless steel parts where high hardness is essential.

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No. 15; carbon .30, chromium 27; heat and corrosion service.

No. 22; carbon .07 max., chromium 19.50, nickel 9; for miscellaneous stainless parts and castings to be polished.

No. 23; carbon .15, chromium 19.50, nickel 9; miscellaneous stainless alloy castings.

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No. 24; carbon .15, chromium 9, nickel 19.50; stainless alloy.

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No. 25; carbon .15, chromium 21, nickel 10; for valves and pump parts for the paper industry.

No. 30; carbon .15, chromium 24, nickel 10; uses same as No. 25.

No. 31; carbon .22, chromium 22, nickel 11; resistant to temperatures up to 2000 degrees Fahr.

No. 32; carbon .50, chromium 15, nickel 35; heat resisting castings requiring strength at elevated temperatures.

No. 34; carbon .06, chromium 20, nickel 30, molybdenum 3.

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CLOVERLEAF—E. A. Williams & Son Inc., Jersey City, N. J. Babbitt metal in grades A, B and 0 and 1, 2, 3 and 4, for bushings, bearings, etc.

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COLALLOY—Colonial Alloys Co., Philadelphia. Furnished in sheets, plates, circles, strip, tubes, coils, pipes, rods, angles, shapes and other forms; can be easily formed, bent, machined, fabricated, welded, etc.; has wide range of tensile strengths, brinell hardness; medium and high ductility; good bearing properties; nonmagnetic; for use as disks, chucks, pulleys, guards, mountings, feed brackets, lever knobs, covers, spindles, rings, collars, bushings, etc.

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COLUMBIA—Columbia Steel & Shafting Co., Pittsburgh; furnished in rods and bars; tensile strength is high; bearing properties good; material machines freely.

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COMMERCIAL—Buckeye Brass & Mfg. Co., Cleveland. Cored and solid bronze bars; copper 80, tin 10, lead 10; for bushings, bearings and bars.

See advertisement, Page 11-D

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COMPO—Bound Brook Oil-less Bearing Co., Bound Brook, N. J. Self-lubricating bushings, bearings and washers; copper 88.75, tin 9.75, graphite 1.5; porous structure containing as high as 35 per cent of oil or other lubricant by volume.

See advertisement, Page 12-D

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COOPER ALLOY—(Formerly Sweetaloy)—Cooper Alloy Foundry Co., Elizabeth, N. J.

No. 16; 18 per cent chromium iron.

No. 17; 18 chromium and 8 nickel.

No. 18; 22 nickel and 10 chromium.

No. 19; 28 per cent chromium.

No. 20; 36 nickel and 18 chromium.

No. 21; 65 nickel and 15 chromium.

No. 22; 28 chromium and 10 nickel; this and above alloys furnished in castings for chemical plant, paper mill, textile and food processing machinery.

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COPPEROID—American Nickeloid Co., Peru, Ill. Copper bonded to zinc, latter serving as rust-proof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for use in continuous feed automatic presses. Can be supplied with quick removable gum adhered paper covering permitting drawing and forming operations without marring pre-finish. For machinery trim, nameplates, change gear index plates, etc.

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CRAMP ALLOYS—Cramp Brass & Iron Foundries Co., Philadelphia.

No. 49; furnished in rough bars or billets, rods or bars, and sand castings; resists heat to 400 degrees Fahr.; high abrasion resistance; tensile strength 120,000 lbs. per sq. in.; compressive strength 55,000; medium ductility; specific gravity, 6.8; good bearing properties; used for heavy duty, slow moving loads.

No. 99; furnished in rough bars or billets and rods or bars; resists corrosion by sulphuric, sulphurous, acetic acids; heat resistant to 450 degrees Fahr.; high abrasion resistance; tensile strength 55,000 lbs. per sq. in.; compressive strength 22,000; good bearing properties; brinell hardness, untreated 100; used for high speed bearings and acid resisting parts.

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CROMIN D—Wilbur B. Driver Co., Newark, N. J. Nickel-chromium-iron; high resistivity, for use in low temperature work.

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CROMONITE—Continental Roll & Steel Foundry Co., East Chicago, Ind. Hard alloy chill roll made in four grades, mild, medium, hard and super-hard for special applications.

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CUMLOY—West Steel Casting Co., Cleveland. A molybdenum-vanadium-nickel alloy for steel castings such as cams, gears, levers, and indexing mechanism parts.

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CUPALOY—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Copper base alloy containing chromium and silver; thermal and electrical conductivity 80-90 per cent pure copper; tensile properties of steel; brinell hardness of 140-160; applications include spot-welding tips, seam-welding wheels and rolls, mechanical parts carrying heavy current, etc. Licensees: A. W. Cadman Mfg. Co., Pittsburgh.

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CUPRON—Wilbur B. Driver Co., Newark, N. J. Nickel copper alloy; supplied in wire and strip form; for rheostats, voltmeters, shunts and other resistances operated below red heat; has moderate resistivity; resists heat to 1000 degrees Fahr.

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CYCLOPS—Universal-Cyclops Steel Corp., Titusville, Pa.

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No. 17-A Metal, (Type No. 325); nickel 20, chromium 8; high strength and ductility; nonmagnetic; for turbine blading, high pressure valves and electrical applications.

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K-Rustless (Type No. 439); chrome 8, tungsten 8, carbon .60; is heat resisting; has bearing and cutlery application.

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CYCLOPS ORION — Universal-Cyclops Steel Corp., Titusville, Pa. Chrome vanadium steel for machine parts.

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CYCLOPS WANDO — Universal-Cyclops Steel Corp., Titusville, Pa. Carbon .95, manganese 1.05, chromium .50, tungsten .50, vanadium .20; oil hardening, nonshrinking tool and die steel.

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D-H-S BRONZE—Koppers Co., Bartlett-Hayward Div., Baltimore. Furnished in rough bars or billets, rods or bars, also as sand castings; zinc 21-25, copper 61-65, hardener (aluminum, manganese and iron) 13-15; resists corrosion, heat resistant to 400 degrees Fahr.; high abrasion resistance; tensile strength, 125,000-130,000 lbs. per sq. in.; compressive strength 90,000; specific gravity .28 lbs. per cu. in.; nonmagnetic; brinell hardness, untreated 255-260; used for heavy-duty bearings, gears, guides, screws, stems, nuts, etc.

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DM-45—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon .40-.50; manganese .40-.70, silicon .50-.80, chromium 1-1.5, molybdenum .45-.65; furnished in rough bars or billets, and finished rods or bars, for hot forging, turning, boring, etc., into parts. Material resists heat to 1100 degrees Fahr.; tensile strength, 150,000 lbs. per sq. in., min., heat treated; medium ductility; and brinell hardness, untreated 185, heat treated 411 max. For bolts, studs and other highly-stressed parts used at elevated temperatures.

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DM STEEL—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon .15 max., manganese .30-.60, silicon .50-1, chrome 1-1.5, molybdenum .45-.65, phosphorus .03 max., sulphur .03 max.; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. into parts. Material resists heat to 1100 degrees Fahr.; tensile strength, ult., 60,000 lbs. per sq. in., min.; medium ductility; fair weldability; and brinell hardness, annealed 163 max. Used for oil refinery field.

Type 2; similar to above with slightly varied analysis; resists heat to 1050 degrees Fahr.; tensile strength, ult., 60,000 lbs. per sq. in. min.; medium abrasion resistance; fair weldability; brinell hardness, annealed 163 max. For oil refinery field, also.

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DAVIS METAL—Chapman Valve Mfg. Co., Indian Orchard, Mass. Corrosion resisting iron; carbon and silicon .5, manganese 1.5, nickel 29, iron 2, copper 67; for valves and fittings.

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DEFIHEAT—Rustless Iron & Steel Corp., Baltimore. No. 446 stainless type; carbon .35 max., chromium 23 to 30; resists nitric and sulphuric acids, also heat to 2000 degrees Fahr.; for furnace parts and other applications involving high heat.

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DEFIRUST—Rustless Iron & Steel Corp., Baltimore.

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No. 410 stainless type; carbon .15 max., chromium 10-14; hardening type of stainless steel for turbine blades.

No. 416 machining type; carbon .15 max., sulphur .15 and chromium 12-14; hardening type of stainless steel possessing free-cutting properties.

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DEFISTAIN—Rustless Iron & Steel Corp., Baltimore.

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Types 302, 304 and 308; carbon .08-.12 max. and .08 max., manganese 2 max., chromium 18-22, nickel 8-12; retains high tensile strength and resistance to creep to 1300 degrees Fahr.; nonmagnetic; resists nitric acid, salt air, and food; resists heat to 1600 degrees Fahr.; recommended for machinery parts which come in contact with food.

Type 303, machining; carbon .20 max., sulphur .15 min., chromium 18-20 and nickel 8-10; has high ductility and free-cutting properties; resists heat to 1550 degrees Fahr., and has tensile strength to 200,000 lbs. per sq. in.; recommended for same purposes as above where free cutting is desirable.

Rustless 18-12 Mo., types 316-317; carbon .09 max., chromium 16-20, nickel 14 max., molybdenum 2-4; corrosion resistant; used for parts in paper and pulp, and chemical industries.

Columbium, type 347; carbon .10 max., chromium 17-20, nickel 8-12; columbium ten times carbon; same properties as Defistain except welded equipment does not require annealing after welding; material is stabilized.

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DEWARD—Allegheny-Ludlum Steel Corp., Pittsburgh. Carbon .9, manganese 1.50, molybdenum .30; for holders for thread chasers and gang punches. Oil hardening.

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DIAMOND G BRONZE—E. A. Williams & Son Inc., Jersey City, N. J. For bearings, bushings and mill brasses, either finished or in the rough.

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DIXOILBRONZ—Thos. F. Seitzinger's Sons, Atlanta, Ga. Bearing bronze, copper base, balance tin and lead with no agents or hardness; resists corrosion due to high lead content; heat resistant to 700 degrees Fahr.; tensile strength, ult., 18,000-30,000 lbs. per sq. in.; compressive strength, ult., 7800-14,000; bearing properties, good; recommended for bearings, bushings, gears, pump runners, pump liners, and for oil field equipment.

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DOLER-ALUMIN—Doehler Die Casting Co., New York. Aluminum base die castings. Composition suited to meet stringent requirements, as high tensile strength, impact strength, hardness, corrosion resistance, thermal conductivity and electrical conductivity.

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DOLER-BRASS—Doehler Die Casting Co., New York. Brass die castings. Composition suited to meet varying conditions. Tensile strength to 100,000 lbs. per sq. in., and hardness to 180 brinell; excellent corrosion resisting properties.

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DOLER-MAG—Doehler Die Casting Co., New York. Magnesium base die castings made from the lightest of the commercial metals; one-third lighter than aluminum.

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DOLER-ZINK—Doehler Die Casting Co., New York. Zinc base die castings of maximum tensile and impact strength.

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DOWMETAL—The Dow Chemical Co., Midland, Mich.

Alloy E; aluminum 6, manganese .20, remainder magnesium; plate, sheet and strip with maximum properties; available in hard rolled and annealed tempers.

Alloy H; aluminum 6, manganese .20, zinc 3, remainder magnesium; sand castings and press forgings for aircraft and general usage; improved salt water resistance; may be heat treated to secure high tensile strength and toughness, or heat treated and aged to secure high yield strength with moderate toughness.

Alloy L; aluminum 2.5, cadmium 3.5, manganese .3, remainder magnesium; best hammer forging alloy, hammer forgings for aircraft and other industries.

Alloy M; manganese 1.5, remainder magnesium; plate, sheet, strip, extruded shapes, die castings and forgings of moderate strength for all uses demanding maximum salt water resistance.

Alloy O; aluminum 8.5, manganese .2, zinc .5, remainder magnesium; simple press forgings and extruded sections of high yield strength.

Alloy R; aluminum 9, manganese .15, zinc .6, remainder magnesium; most generally used die casting alloy combining maximum toughness and elongation with good tensile and yield strengths.

Alloy J; aluminum 6.5, manganese .2, zinc .7, remainder magnesium; press forgings, extruded bars, rods and shapes, and tubes.

Above alloys may be used in reciprocating, rotating or manually handled parts where light weight is desirable.

See advertisement, Page 7-D

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DRAGON—Allegheny Ludlum Steel Corp., Pittsburgh. Carbon .33, manganese .55, chrome .65, molybdenum .35; high degree of toughness with moderate hardness; water hardening; for use as bucket teeth, keys, pins, bolts, studs, etc.

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DRIVER-HARRIS 42 ALLOY — Driver-Harris Co., Harrison, N. J. Notable for its coefficient of linear expansion—approximately that of different grades of glass.

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DRIVER-HARRIS 52 ALLOY — Driver-Harris Co., Harrison, N. J. Alloy of nickel and iron which has been successfully used for sealing in glass and in which process no coating is required prior to the operation.

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DUCTILOY—Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit. Carbon 15, manganese .70, chrome .55, silicon .85, nickel .15, copper .20, zirconium .15 phosphorus .025, sulphur .025; furnished in rough bars or billets, finished rods or bars, sheets, strips, plates, for hot forging, stamping, extruding, turning, boring, welding, cold forming, etc.; abrasion resistance, medium; tensile strength, ult., 75,000-80,000 lbs. per sq. in.; ductility, high; specific gravity, 7.85; weldability, good; brinell hardness, untreated 160; fatigue and impact resistant; for frames, bases, small axles and power transmission shafting.

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DUPLEX—Crucible Steel Co. of America, New York.

No. 1; nickel 3.50, chromium 1.50; forging steel; for shafts and machine parts requiring high strength and toughness; also made in case carburizing type.

No. 2; nickel 1.75, chromium 1; also a forging steel for applications similar to those of No. 1, and made in case carburizing type.

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DUQUESNE SPECIAL—Continental Roll & Steel Foundry Co., East Chicago, Ind. Chrome molybdenum steel for rolls subject to severe service; also for abrasive castings.

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DURACAST—West Steel Casting Co., Cleveland. For steel castings of 90,000 lbs. per sq. in. tensile strength and brinell hardness of 180; for cams, gears, etc.

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DURCO—Duriron Co. Inc., Dayton, O. Alloy steels (KA2S, KA2SMo., etc.); 18 chrome, 8 nickel, carbon max. .07, and other standard as well as special analyses preferred by users; for pumps, valves, fittings, castings for corrosive service, etc.

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

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DUREX—Moraine Products Div., General Motors Corp., Dayton, O. Product of powder metallurgy in iron, bronze and other metals; self-oiling bearings and various small parts for electric motors, automobiles, domestic and other machinery.

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DURICHLOR—Duriron Co. Inc., Dayton, O. Silicon 14.5, molybdenum 4, carbon .80, traces of phosphorus and sulphur, balance iron; for pumps, valves, pipe, castings for corrosive service, especially for hydrochloric acid and chloride solutions.

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DURIMET—Duriron Co. Inc., Dayton, O. Nickel 23, chromium 20, silicon, molybdenum and copper 5 approx., carbon .07 max., balance iron; for pumps, valves, bolts, nuts and castings for corrosive service, especially weak sulphuric acid.

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DURIRON—Duriron Co. Inc., Dayton, O., and licensees. Silicon 14.50, carbon .80, manganese .60, sulphur and phosphorus traces, balance iron; for pumps, valves, exhaust fans, mixing nozzles, and castings for handling acids and other corrosive liquids and gases.

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DURONZE ALLOYS—Bridgeport Brass Co., Bridgeport, Conn. High copper silicon bronzes alloyed with elements such as tin, iron, aluminum, etc.; possess high strength combined with corrosion resistance.

I; possesses excellent cold working properties; cold headed bolts and screws, average 100,000 lbs. per sq. in. tensile strength; available in rod, wire and sheet form.

II; hot rolled sheet for making range boilers, automatic heaters and storage tanks by either electric arc or oxyacetylene welding methods; cold rolled strip used as a substitute for phosphor bronze spring metal; rod and wire used for making hot headed bolts and screw products; supplied in sheet, rod, wire, tube and ingot forms.

III; supplied in rod form; tensile strength about 100,000 lbs. per sq. in.; hot forgings about 90,000 lbs. per sq. in.; free machining for making screw machine parts, also for sucker rods for corrosive oil wells; ten per cent lighter than brass; excellent corrosion resistance; in ingot form may be used for making sand castings with tensile strength about 70,000 lbs. per sq. in.

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IV; made into condenser tubes only; for resisting corrosion from aerated sea water.

V; wire for making difficult cold headed parts, screws, bolts; malleable; good corrosion resistance; tensile strength, about 100,000 lbs. per sq. in.; for outdoor use.

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DUTCH BOY BABBITT—National Lead Co., New York. Analysis varies for different bearing applications.

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DYNAMIC STEEL—Continental Roll & Steel Foundry Co., East Chicago, Ind.

C-2; carbon-manganese-nickel cast steel for parts requiring high physical properties; for tractor frames, locomotive castings, etc.

C-3; carbon-manganese-nickel cast steel for resisting wear after a preferential heat treatment; for sprockets, spindles, wheel centers, cross heads, etc.

C-3-A; carbon-manganese-molybdenum cast steel for parts requiring high physical properties, with machinability; for gears, racks, sprockets and miscellaneous castings.

C-6; chromium cast steel for special abrasive and crushing work; for sand mills, rock crushers, etc.

C-7; carbon-chromium-nickel-molybdenum cast steel for castings requiring high physical and severe service qualities.

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EASY-FLO—Handy & Harman, New York. Brazing alloy; silver 50, copper 15.5, zinc 15.5, cadmium 18; resists corrosion due to silver content; specific gravity 9.49; for brazing ferrous and nonferrous metals, particularly dissimilar metals and monel metal, stainless steel and other copper-nickel and chrome-nickel alloys.

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ECONOMET—General Alloys Co., Boston. Nickel 30, chromium 10; resists heat to 1800 degrees Fahr.; tensile strength, 70,000 lbs. per sq. in.; for castings subject to high temperatures.

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ECONOMO—Wheelock Lovejoy & Co. Inc., Cambridge, Mass. Carbon .20 and .50 with alloy of molybdenum; free machining; for machine tool parts.

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EIS 45—Heppenstall Co., Pittsburgh. Carbon .85, chrome .12. Furnished for hot forging into parts. Used for shear blades for shearing medium heavy material.

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ELASTUF—Horace T. Potts Co., Philadelphia.

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Type A steel, heat treated; special analysis chrome vanadium steel; carbon .25-.35 up to 2 in. round, and carbon .45-.55 over 2 in. round; furnished in rough bars or billets and forgings, for turning, boring, etc. Has excellent tensile strength at elevated temperatures. Used where maximum strength, resistance to impact, fatigue, wear, shear or compression is required.

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Type A alloy steel, annealed; special analysis chrome vanadium steel; carbon .45-.55; furnished in rough bars or billets and forgings. Brinell hardness, untreated 200, heat treated 600. For parts which must be hardened and where maximum toughness is required such as cams, plastic molds, mandrels, clutch parts, etc.

Licensees are: Brown-Wales, Boston; Beals, McCarthy & Rogers Inc., Buffalo; Equitable Equipment Co., New Orleans.

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ELASTUF CHRO-MOLY—Horace T. Potts Co., Philadelphia. Chrome - molybdenum alloy steel, hot rolled, heat treated; carbon .35-.45 up to 4 in. round, and .45-.55 carbon over 4 in. round; furnished in rough bars or billets and forgings, for turning, boring, etc. Used for heavy-duty parts requiring high tensile properties with exceptional impact strength.

ELECTROMET—Electro Metallurgical Sales Co., New York. A line of ferro-alloys and alloying elements of various analyses.

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ELECTRUNITE—Steel & Tubes Inc., Cleveland. Electric-welded tubing in stainless, carbon, copper bearing steel and rust-resisting copper molybdenum iron (Toncan). Square, rectangular, oval or other shapes in any size or gage where the periphery of the shape is not less than 2-1/32 in. or more than 16 in. For general mechanical purposes.

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ELINVAR—Produced by Acieries d'Imphy France; marketed in United States and Canada by R. Y. Ferner Co., Boston. Alloy with low thermal coefficient of elasticity; nickel 33-35, iron 53-61, chromium 4-5, tungsten 1-3, manganese .5-2, silicon .5-2, carbon .5-2; for watch and instrument hairsprings and tuning forks.

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ELKALOY—P. R. Mallory & Co. Inc., Indianapolis. A work-hardened alloy of copper, not heat-treatable, for spot and seam welding aluminum and its alloys, unpickled hot rolled steel, terne plate, tin plate, galvanized iron and other materials. A direct substitute for copper, it handles the same but is harder and lasts longer.

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ELKONITE—P. R. Mallory & Co. Inc., Indianapolis. Two definite classes of materials. One group based on copper and such refractory metals as tungsten, molybdenum and their carbides—combinations which produce material with good electrical conductivity and great wear-resistant qualities, for use as welding electrodes and contactors in oil-immersed circuit breakers. Another group is based on silver and refractory materials such as tungsten, molybdenum and their carbides, and has been developed primarily as a facing material for heavy duty electrical contacts and contactors for air breakers. This material can be used either in the form of a thin facing or as an insert with copper or copper alloy backing material.

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ELVERITE—Babcock & Wilcox Co., New York. Special chilled iron castings; for tube mill lining, car wheels, jaw crushers, sprockets, etc.

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ENDURO—Alloy Steel Div., Republic Steel Corp., Massillon, O. Stainless and heat resisting alloy.

Chromium-nickel group:

17-7; chromium 17, nickel 7, carbon .10-.20; used for automotive trim and for deep drawing where straight chromium types are not sufficiently ductile.

18-8; chromium 18, nickel 8, carbon .08-.20; especially suited to resist atmospheric corrosion and corrosion reagents; for dairy and chemical plant equipment, food and meat processing machinery, high strength, light weight structural members, and for resistance to oxidation at elevated temperatures.

18-8 S; similar to 18-8 except carbon is kept under .08 which permits its use in welded equipment subject to severe corrosion.

18-8-FS; a special modification of 18-8 to develop greater softness and less work hardening; better adapted to successive drawing and spinning operations with less annealing than 18-8.

18-8 S Ti; 18-8 S to which titanium has been added for eliminating intergranular corrosion at high temperatures; used for airplane collector rings and exhaust manifolds, and other high temperature requirements.

18-8 S Cb; 18-8 S plus columbium; for applications similar to those for which 18-8 S Ti is recommended. More efficient as carbide stabilizer and better corrosion resistance than titanium.

18-8 S Mo; 18-8 S plus 2 to 4 molybdenum; resistant to acids encountered in paper and pulp processes, woolen dyeing and in chemical and pharmaceutical industries; recommended for severe corrosive conditions; good fabricating and welding properties.

18-8-B; 18-8 with 2 to 3 silicon; for resistance to oxidation in temperatures up to 1700 degrees Fahr.; for annealing boxes, furnace parts, etc.

18-8-FM; a free-machining type of 18-8 through addition of .15-.30 selenium; machinability very good for chromium-nickel type—about 60 per cent that of screw stock. Corrosion resistance same or little less than 18-8.

19-9 SMo; a modification of 18-8-SMo with higher alloy content for applications requiring somewhat higher corrosion resistance than 18-8-SMo.

HCN; chromium 25, nickel 12; for resistance to oxidation up to 1950 degrees Fahr.; fabricates, machines, and welds readily. High strength and creep at elevated temperatures. Not recommended for high sulphur conditions at high temperatures.

HCN-Low Carbon; a variation of HCN with carbon .80 max. for applications involving welding and corrosion resistance to eliminate carbide precipitation.

NC-3; chromium 25, nickel 20, silicon 2 max.; for maximum heat resistance. Best strength and creep at high temperatures, but may be attacked if sulphur present in gases. Resistant to carburizing.

S-Turbine Quality; chromium 11.5-13, carbon .15 max. used for applications where corrosion resistance and physical strength are needed at medium high temperatures.

S-High Carbon; a straight chromium, high carbon grade for heat treating for high hardness applications.

Straight chromium group:

S-1; chromium 11.5-13, carbon .12 max., responds readily to heat treatment and is recommended where strength, toughness and hardness are required; for pump shafts, valve seats and stems, nuts and bolts, etc.

S-1 Nickel; a modification of S-1 with addition of 2 max. nickel for somewhat better physical properties than S-1.

FC; free machining grade of S-1 analysis. Machines nearly as well as screw stock.

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

Fairly resistant to the atmosphere, organic and fruit acids, etc. Can be hardened by heat treatment up to about 400 brinell. Considerably more care and control required in forging operations than with S-1.

FC High Carbon; a high carbon variation of FC having better physical properties than FC.

AA; chromium 14-18, carbon under .12; good corrosion resistance and heat resistant to 1500 degrees Fahr.; general corrosion resistance; fabricating and welding properties inferior to 18-8; for bicycle fenders, oil burner parts, etc.

AA High Carbon; a variation of AA with somewhat better physicals.

AA-FM; a free-machining modification of AA with machinability about 85-90 per cent of Bessemer screw stock.

HC; chromium 18-30; heat resistant to 2000 degrees Fahr.; not affected by sulphur gases; strength and creep at high temperatures not as good as the chromium-nickels.

18-23; chromium 18-23; high heat resisting properties; good resistance to scaling, but strength and creep lower than chromium-nickel types; for furnace parts, etc.

4-6 per cent; chromium 4-6 with several carbon ranges to .25 and with or without addition of molybdenum or columbium, titanium, aluminum and tungsten; additions of columbium, titanium or aluminum practically eliminate air hardening on welding; corrosion and heat resistance considerably superior to that of carbon steels, and with fair strength at high temperatures; for oil refinery and furnace parts.

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ERMAL—(Z-Metal)—Erie Malleable Iron Co., Erie, Pa. A spheroidized pearlite malleable cast iron; for castings requiring rigidity and high tensile strength. Suitable for heat treatment.

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ERMALITE—Erie Malleable Iron Co., Erie, Pa. Wear-resisting alloy iron; for gears, wearing plates, friction drums and other parts subject to high stresses or wear.

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EVANSTEEL—Chicago Steel Foundry Co., Chicago. Nickel 1-1.5, chrome .65-1, carbon varies from .30-.50, sometimes carries additions of vanadium or molybdenum; for castings such as passenger car knuckles, tooth bases, sprockets, gears, high pressure valves, etc.

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EVERDUR—American Brass Co., Waterbury, Conn.

Alloy No. 1010; copper 96, silicon 3, manganese 1; uses include tanks and sewage disposal apparatus.

Alloy No. 1015; copper 98.25, silicon 1.50, manganese .25; easily fabricated by all methods including welding; used for tubes, bolts and screws.

Alloy No. 1000; casting alloy; copper 90.94, manganese 1.01, silicon 4.

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FARRELL'S 85—Farrell-Cheek Steel Co., Sandusky, O. Specially processed steel castings for resisting abrasion, and possessing high strength, toughness and rigidity; tensile strength 150,000 lbs. per sq. in.; used for parts subject to shock, high stress, overload, wear and abrasion.

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FEDERAL-MOGUL BRONZES—Federal-Mogul Corp., Detroit.

F1; a gear bronze suitable for heavily loaded piston pin bushings, etc.

F2; lead bronze for average bushing application.

F3; used largely as backs for babbitt-lined bearings.

F5; widely used for babbitt-lined bearing backs and for bushings where service is not severe.

F6; for average bushing applications.

F8; good casting and machining qualities.

F11; for piston pin bushings and other low speed, heavily loaded applications.

F13; suitable for many of the uses to which F1 is applied.

F15; has 20 per cent lead and may be used safely under adverse lubrication conditions.

F16; because of high lead content may be used where only occasional lubrication is possible.

F18; high lead alloy of good casting characteristics.

F19; strong ductile alloy of average hardness with bearing qualities corresponding to other low lead compositions.

F20; a hard bronze used for gears and worm wheels where requirements are severe; also aluminum bronze and special analysis bronzes.

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FERROWELD—Lincoln Electric Co., Cleveland. For arc welding cast iron. Has steel base to give solid weld on cast iron of greater tensile strength than the cast iron itself. Due to low current which can be used, hardening effect usually present along the line of fusion is materially reduced.

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FIRTHITE—Firth-Sterling Steel Co., McKeesport, Pa. Hard metal composition of sintered carbides furnished in number of grades to form wearing surfaces or the edges of cutting tools.

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FIVEPOINT DEEPHARD STEEL—Foote Brothers Gear & Machine Corp., Chicago. Nickel-molybdenum alloy, for hot forging, turning, boring, etc.; resists heat to 250 degrees Fahr. steady, and 300 degrees Fahr. intermit.; abrasion resistance, high; tensile strength, ult., 216,000 lbs. per sq. in.; ductility, high; bearing properties, good; for use where abrasion, erosion, fatigue and shock resisting qualities are desired.

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FLAMALOY—Detroit Alloy Steel Co., Detroit. Furnished as castings. Carbon .35-.45, manganese 1-1.25, chromium 1-1.10, copper .90-1, molybdenum .30-.45; medium abrasion resistance; tensile strength, ult., 130,000 lbs. per sq. in.; high ductility; recommended heat treatments approx. 1500 degrees Fahr. water quenched; brinell hardness, untreated 200, heat treated 630; for miscellaneous machine parts.

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FLEETWELD—Lincoln Electric Co., Cleveland. Shielded arc electrode for welding mild steel.

Type 5; for flat, vertical and overhead welding. Tensile strength, 65,000-75,000 lbs. per sq. in.; ductility, 20 to 30 elong. in 2 in.; impact resistance, 30-70 ft. lbs. (Izod); density 7.84-7.86 grams per c.c.; corrosion resistance greater than mild steel.

Type 7; for general purpose welding and where fit-up is not of the best; low spatter and slag loss, high burn-off rate. Physical properties as welded; tensile strength, 70,000-80,000 lbs. per sq. in.; yield point 55,000-66,000 lbs. per sq. in.; ductility, approximately 17 per cent elong. in 2 in.; specific gravity, 7.80.

Type 8; heavily-coated electrode of shielded arc type for fillet welding in down positions only. Capable of producing fillets, (one plate vertical), up to 3.8 in size in one pass. Tensile strength, 65,000-75,000 lbs. per sq. in.; yield point 47,000-63,000 lbs. per sq. in.; elong. 20 to 30 per cent in 2 in. Can be used with either alternating or direct current.

Type 9; heavily-coated electrode of shielded arc type specifically for flat welding of deep groove joints. Physical properties as welded; tensile strength, 66,000-74,000 lbs. per sq. in.; yield point, 55,000 to 60,000 lbs. per sq. in.; elong. 20 to 30 per cent in 2 in.; specific gravity, 7.85 to 7.86; operates either with d.c. or a.c.

Type 10; for downhand welding on flat surfaces for finish bead welding and to provide full slag coverage and smoothness. Can be used with either direct or alternating current normal or reverse polarity.

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FRONTIER—Frontier Bronze Corp., Niagara Falls, N. Y.

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No. 40 Ti-Aluminum; aluminum-chrome-magnesium-titanium-zinc alloy; furnished in rough bars or billets, finished rods or bars, tubing, sheets, and as castings; resists corrosion caused by salt water; resists heat to 600 degrees Fahr.; abrasion resistance, high; tensile strength, ult., 35,000-40,000 lbs. per sq. in.; compressive strength, ult., 30,000-35,000; brinell hardness, untreated 90; for use where strength at high temperatures are required.

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No. 5 Alloy; copper-aluminum and iron alloy, furnished as castings; tensile strength, ult., 60,000-95,000 lbs. per sq. in.; compressive strength, ult., 22,000-65,000 lbs. per sq. in.; ductility, medium; brinell hardness, untreated 130, heat treated 140-200; for parts where high fatigue is required.

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GLYCO BABBITT—Joseph T. Ryerson & Son, Inc., Chicago. General tradename covering a group of specially processed lead base alloys including:

Turbo-Glyco; for high speed, heavy-duty; average brinell hardness, 30.

Marine Glyco; for electric motor and marine work; average brinell hardness 27.

Standard Glyco; free flowing, general purpose; average brinell hardness 24.

Heavy pressure mill Glyco; high resistance to crushing loads; average brinell hardness 23.

Transmission Glyco; for line shafting and transmission work; average brinell hardness, 22.

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GRAMIX—The United States Graphite Co., Saginaw, Mich. Bearing bronze; resists heat to 300 deg. Fahr.; tensile strength, 12,000 lbs. per sq. in.; compressive strength 100,000 specific gravity, 5.9-6.1 (apparent density) brinell hardness, untreated, 500 kilograms—28; used for bearings, contacts, slides and thrust bearings.

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GRAPHO—Lehigh Babbit Co., Allentown, Pa. A homogeneous mixture of graphite and babbitt which can be poured in the usual way; recommended for bearings subject to lubricating difficulties.

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GRAPH-MO—Timken Steel & Tube Div. The Timken Roller Bearing Co., Canton, O. Carbon 1.50, silicon .80, magnesium .40 max., phosphorus and sulphur .025, manganese .025, molybdenum .25; furnished in rough bars or billets, finished rods or bars, tubing, wire, strips and plates, for hot forging, stamping and welding into parts. Has high abrasion resistance; tensile strength, ult., 85,000 lbs. per sq. in., min.; medium ductility; fair bearing properties; good weldability; recommended heat treatments for annealing, normal 1600 degrees Fahr.; hardening 1450 degrees Fahr.; oil quenched, 1475-1550 degrees Fahr.; brinell hardness, untreated 197, heat treated 745. Used for sliding or rotational service.

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GRAPH-SIL—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon 1.50, silicon .90-1, manganese .40 max., phosphorus and sulphur .025 max.; furnished in rough bars or billets, finished rods or bars, tubing, wire, strips and plates, for hot forging, stamping, welding, turning boring, etc. Tensile strength, ult., 97,000 lbs. per sq. in., min.; abrasion resistance, high; medium ductility; good bearing properties and weldability; for use in sliding or rotational service.

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GRAPH-TUNG—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon 1.50, manganese .40 max., phosphorus and sulphur .025, max., silicon .65, molybdenum .50, tungsten 3; furnished in rough bars or billets, finished rods or bars, wire, sheets, strips and plates, for hot forging, stamping and welding. Has high abrasion resistance; tensile strength, ult., 95,000 lbs. per sq. in., min.; medium ductility; fair bearing properties; good weldability; and brinell hardness, untreated 229, heat

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

treated 840; used for sliding and rotational service.

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HALCOMB—Halcomb Steel Div., Crucible Steel Co. of America, Syracuse, N. Y.

Stainless Steels: Grade A, chrome 12.5; Grade B, chrome 17.

Stainless Irons: FM2, chrome 12; for free machining corrosion resistant parts.

No. 12; chrome 12 to 13.

No. 16; chrome 15 to 16.

No. 18; chrome 18 to 20.

No. 24; chrome 24 to 26.

NCR-238 and Rezistal; stainless steels in various grades for corrosion and heat resistant parts.

HANDY FLUX—Handy & Harman, New York. For brazing steel, stainless steel, monel metal, nickel, copper, beryllium-copper, brass, bronze, aluminum bronze and various other ferrous and nonferrous metals and alloys.

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HARDTEM—Heppenstall Co., Pittsburgh. Carbon .5, nickel-chrome-molybdenum die steel; for die blocks, shafting, etc.

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HARDWELD—Lincoln Electric Co., Cleveland. High carbon arc welding electrode having brinell of 225-488; provides dense, tough surface of moderate hardness to enable various steel parts to resist shock and abrasion; for locomotive or crane tire flanges, etc..

Type 50; medium carbon steel electrode for building up steel parts and surfaces. Deposit has considerable resistance to deformation and wear, and is machinable at slow speed. Coating stabilizes the arc and permits deposition of a tough, dense medium carbon steel. Hardness, deposited on straight carbon steel and allowed to cool naturally, 20 to 35 Rockwell C.

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HASCROME—Haynes Stellite Co., Kokomo, Ind. Alloy of chromium, manganese and iron; castings, sheet and hard-facing welding rod for parts subject to abrasion and impact.

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HASTELLOY—Haynes Stellite Co., Kokomo, Ind. Corrosion-resistant alloys for piping, tanks, pump parts, valves, vessels, etc.

A and B; nickel, molybdenum and iron.

C; nickel, molybdenum, chromium and iron.

D; nickel and silicon.

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HAYNES 93—Haynes Stellite Co., Kokomo, Ind. Ferrous alloy welding rod for hard-facing metal wearing parts; abrasion resistance, high; tensile strength, ult., 50,000-60,000 lbs. per sq. in.; Rockwell hardness, untreated C-62, heat treated, C-67.

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HAYNES STELLITE—Haynes Stellite Co., Kokomo, Ind. Nonferrous cobalt-chromium-tungsten alloy for corrosion and wear-resistant castings, metal-cutting tools, hard-facing welding-rod for parts subject to abrasion or a combination of abrasion, heat and corrosion.

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HAYSTELLITE—Haynes Stellite Co., Kokomo, Ind. Cast tungsten carbide; inserts, tube, rod, and composite rod (welding) for hard-facing oil-well drilling tools, dredge cutter blades, etc.

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HEPPENSTALL 2 C 30—Heppenstall Co., Pittsburgh. Nickel-chrome-molybdenum steel, carbon .3; for shafting where high torsional strength is required such as drop hammer piston rods.

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HEPPENSTALL 5 H 50—Heppenstall Co., Pittsburgh. Carbon .5, chrome, molybdenum and vanadium alloy furnished as die blocks. Material is heat resistant, abrasion resistant, has high tensile strength and high ductility. Used also for strip mill rolls, etc.

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HERCULOY—Revere Copper & Brass Inc. New York. Silicon-bronze; silicon 3.25, tin .50, balance copper; in addition to properties indicated, it is nonmagnetic; made in sheets, strip, plates, cold drawn rods, shafting, welding rod, forgings, ingot form for sand castings; tensile strength, ult., 120,000 lbs. per sq. in.; weldability, good; brinell hardness, untreated 90, coldworked, 200; for piston rods, shafting, electrical construction, etc.

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HILLS-McCANNA—Hills-McCanna Co., Chicago.

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Tin Bronze Alloy No. 1; copper 88-90; tin 10-12; tensile strength, 35,000-40,000 lbs. per sq. in.; brinell, untreated 60, heat-treated 70; for use as gear, bearing and bushing metal. Additional types, varying slightly in analyses depending on use include: No. 2, standard gear bronze; No. 5, gear bronze with small percentage of nickel; No. 10, bearing and bushing bronze; No. 11, acid-resisting bronze; No. 20, high-grade red brass; No. 21, commercial red brass; and No. 22, commercial yellow brass.

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Silicon Bronze Alloy No. 20P; composed of copper, silicon, iron, special hardeners and fluxes in correct proportion to bring about desired physical properties. Tensile strength, 39,800-41,000 lbs. per sq. in.; brinell hardness, untreated 78, heat-treated 80. This alloy is used in place of red brasses No. 20 and in some instances No. 2 (above). Additional types, Nos. 39, 102P and 103P, are also available in varied analyses depending on use. For use extensively as gears, bearings and parts requiring exceptional strength, good corrosion resistance and pressure service.

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Aluminum Bronze Alloy No. 41; a hard tough bronze with tensile strength 80,000-85,000 lbs. per sq. in.; brinell hardness, untreated 170, heat-treated 179. Used for gears, worms and parts requiring great strength. additional types with varying analyses in accordance with requirements are offered as follows: No. 42, an all-around gear and bearing metal; No. 43, softer bronze with great strength for bearings, bushings and various construction parts; No. 45, aluminum-bronze for acid-resisting parts; No. 46, high-tensile, hard bronze for slides, etc., to eliminate scoring, and in many instances to replace steel; No. 49, an exceptionally hard metal used for dies, forming tools, etc.; Nos. 52, 53 and 53 H.T., regular aluminum bronzes with addition of nickel to provide greater variety of physical properties, with greater resistance to corrosion; No. 53 H.T. used extensively for heat treating purposes; No. 54, a Monel metal; and No. 55, a Monel with silicon, being smoother and having greater corrosion resistance. Above alloys used extensively because of great strength, resistance to corrosion, fatigue, shock and excessive wear.

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Manganese Bronze Alloy No. 30A; copper-zinc-aluminum-manganese and iron composition, in proportions to secure desired physical properties. Tensile strength, 57,200-62,000 lbs. per sq. in.; brinell, untreated 96, heat-treated 99. Available in two other grades, Nos. 30B and 30D. Alloys have great strength and resistance to corrosion.

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HIPERNIK—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. A magnetic alloy consisting of 50 per cent nickel and 49 iron; extremely ductile; developed for special magnetic properties at moderately low induction, primarily for radio applications; melting point is 1450 degrees Cent.; sometimes used for heater elements for high temperature furnaces with reducing atmospheres.

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HOYT BABBITT METAL—National Lead Co., New York. Analysis according to bearing application.

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HUBBARD SPECIAL—Continental Roll & Steel Foundry Co., East Chicago, Ind. Nickel chrome steel for wear-resisting rolls, guides and miscellaneous castings.

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HYBNICKEL—Hybnickel Alloys Co., Wilmington, Del.

Types A, B, C, D, R and S; a series of nickel-chrome alloys for heat and acid resistance. Tensile strength, ult., 90,000 lbs. per sq. in.; ductility, medium; weldability, fair.

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HYLASTIC—American Steel Foundries, Chicago. Carbon .35, manganese 1.50, vanadium .10-.12, phosphorus and sulphur not over .05; also furnished with the addition of chromium where greater resistance to abrasion is desirable; tensile strength, ult., 95,000 lbs. per sq. in., compressive strength, 55,000 lbs. per sq. in.; for rolling mill machinery, automotive and railroad equipment, hammer mills and hydraulic machinery.

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HY-SPEED—Buckeye Brass & Mfg. Co., Cleveland. Copper 88, tin 10, lead 2; for bushings, bearings, bars.

See advertisement, Page 11-D

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HYTEMCO—Driver-Harris Co., Harrison, N. J. Alloy of nickel and iron characterized chiefly by its high temperature coefficient of electrical resistance; lends itself advantageously to uses requiring self regulation by temperature such as immersion heaters and heater pads.

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HY-TEN—Wheelock-Lovejoy & Co. Inc., Cambridge, Mass. Chrome-manganese-molybdenum and chrome-nickel-molybdenum alloys with carbon from .10-1; for machine parts

I

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IDEALOY—Wellman Bronze & Aluminum Co., Cleveland. Copper-tin-zinc alloy for heavy duty bearings.

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ILLIUM—Burgess-Parr Co., Freeport, Ill.

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G; nickel 58, chromium 22, copper 7, molybdenum 4-6, balance iron, tungsten and manganese; brinell hardness 170-220; for pumps, meters, chemical equipment and other parts subject to corrosion; resists heat to 2200 degrees Fahr.; resists most corrosion solutions except chlorides and other halogens; used for parts subject to corrosion in rayon and chemical industries.

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R; nickel 58, chromium 21-23, copper 0-4, molybdenum 4-6, balance iron, tungsten and manganese; brinell hardness 175-240 untreated, and up to 365 heat-treated; resists most corrosive solutions except those containing chlorides and other halogens; resists heat to 2000 degrees Fahr.; tensile strength 90,000-105,000 lbs. per sq. in. annealed and 140,000-150,000 upon work hardening; used for parts subject to corrosion in rayon and chemical industries.

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INCONEL—International Nickel Co. Inc., New York. Nickel 79.5, iron 6.5, copper .2, manganese .25, silicon, .25, carbon .08, chromium 13; resists heat to 2000 degrees Fahr.; uses include high temperature applications, springs, and machinery handling food products.

See advertisement, Page 13-D

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INDUSTRIAL—Industrial Steels Inc., East Cambridge, Mass.

Stainless Steel, No. 35; chrome 13-14, carbon .30-.40. No. 65; chrome 16-17, carbon .60-.70. No. 100; chrome 17-18, carbon .9-1.

Stainless Iron, No. 12; chromium 11.5-13. No. 18; chromium 16-20. No. 512; chromium 11.5-13, .12 carbon, .3-.4 sulphur, balance iron. No. 188; chromium 17-20, nickel 8-10. No. 5188; chromium 17-20, nickel 8-10. No. 188 SMO; chromium 17-20, nickel 8-10, molybdenum 2-4 per cent.

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INGACLAD—Ingersoll Steel & Disc Div., Borg-Warner Corp., Chicago.

Stainless clad steel consisting of a 20 per cent layer of 18-8 chrome nickel, Type 306, also 18.8 columbium stabilized and 18-8 molybdenum bearing, stainless layer bonded to a layer of ordinary steel; uses include equip-

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

ment for chemical, food, dairy, processing, brewery, packing house, bottling industries, etc.; suitable for applications requiring stainless steel protection on one surface.

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INLAND—Inland Steel Co., Chicago.

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Copper bearing steel; used largely for sheets; copper minimum .20.

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Silico-manganese spring steel.

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Hi-Steel; high strength, high ductility low-alloy steel for applications where increased strength and corrosion resistance with decreased weight is desired. A copper-nickel-phosphorus alloy steel.

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INVAR—Produced by Acieries d'Imphy, France; marketed in United States and Canada by R. Y. Ferner Co., Boston. An alloy with a low coefficient of thermal expansion; nickel 36, iron 61-64, carbon 0-1, manganese .1-1, silicon .1-1; for clock pendulums, instruments, struts for auto pistons.

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IRALITE—Mackintosh-Hemphill Co., Pittsburgh. Alloy iron; specified where sand cast iron could be used except for lack of strength.

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IDEALOY—Wellman Bronze & Aluminum Co., Cleveland. Copper-tin-zinc alloy for heavy-duty bearings.

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ISOROD—Resisto-Loy Co., Grand Rapids, Mich. Carbon 3, silicon 1, manganese 2, chromium 2, molybdenum 5, nickel 2; fair resistance to acids and alkalies; resists heat to 800 degrees Fahr.; tensile strength, 78,000 lbs. per sq. in.; brinell hardness 545; for use where wear and shock resistant properties are desired.

J

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J & L CORRECT BALANCE (Forging Steel)—Jones & Laughlin Steel Corp., Pittsburgh. Furnished in rough bars or billets, finished rods or bars, and plates, for hot forging. Tensile strength, compressive strength, ductility, weldability, and heat treatments are as specified. Used for any carbon steel parts made from forgings.

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JALCASE—Jones & Laughlin Steel Corp., Pittsburgh.

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Low carbon open hearth steel which offers machinability practically equivalent to Bessemer screw stock plus the added advantage of rapid case carburizing properties; manufactured as S.A.E. X1314 and S.A.E. X1315 in .10 to .20 carbon grades.

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Open hearth steel which in the higher carbon ranges offers exceptional heat treating qualities combined with forging properties and good machinability; manufactured as S.A.E. X1330 (.25-.35 carbon), S.A.E. X1335 (.30-.40 carbon) and S.A.E. X1340 (.35-.45 carbon).

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JAL-TEN—Jones & Laughlin Steel Corp., Pittsburgh. High tensile steel; especially suitable for machine frame or bin construction; adaptable to hot or cold forming and is easily welded or punched for rivets or bolts; made in standard sections and shapes as specified.

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JOHNSON—Johnson Bronze Co., New Castle, Pa.

No. 27; copper 80, tin 10, lead 10; deoxidized with phosphorus; general purpose bearing bronze.

No. 19; copper 70, tin 11, lead 19; high wear rating and resistance to pounding; for mill bearings, gas and diesel engines, excavating and pulverizing machinery, etc.

No. 25 (plastic bronze); copper 75, tin 5, lead 19, nickel 1; for high speed with light to medium loads and generally free from shock; because it has good acid resistance it is particularly suitable for pump bearings and sleeves, and also for electric motor, conveyor and fan, and woodworking machinery bearings.

No. 29; copper 78, tin 7, lead 15; for use where spindle is of soft steel and speed is relatively high; acid resisting alloy.

No. 53; copper 88, tin 10, zinc 2; for severe service or heavy pressures; should be used where shaft is hardened steel and well lubricated.

No. 72; copper 83, tin 7, lead 7, zinc 3; best suited for moderate speeds and low loads.

No. 10 (babbitt alloy); tin 90, antimony 5, copper 5; for thin linings and also may be used in die castings.

No. 11; tin 87, antimony 7, copper 6; rather hard babbitt recommended as lining for connecting rods and shaft bearings subjected to heavy pressures.

No. 12; tin 90, antimony 7.5, copper 2.5; for high speeds and high temperatures.

See advertisement, Page 6-D

K

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K-42-B—Westinghouse Electric & Mfg. Co., East Pittsburgh. Nickel 45, cobalt 25, iron 8, chromium 20, titanium 2; furnished in rough bars or billets, rods or bars, wire, strips (coiled), and plates; for hot forging, stamping, turning, boring, welding, etc., also furnished as sand castings; resists corrosion caused by atmosphere and salt solutions; resists heat to 2000 degrees Fahr.; tensile strength, ult., 160,000 lbs. per sq. in.; nonmagnetic; brinell hardness, heat-treated 300-400; for applications where corrosion resistance, heat resistance, high strength at high temperatures are required.

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KLEENKUT—Heppenstall Co., Pittsburgh. Tool steel containing 2 carbon and 12 per cent chromium; for shear knives for cold shearing light material.

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KONAL—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Nickel 72, cobalt 17, titanium 2.2, iron 6.25; internal combustion engine valves, molds and machine parts subject to stress at temperatures to 650 degrees Cent.

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KOVAR—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Low expansion to 400 degrees Cent.; approximately 28.2 nickel, 18 cobalt, 53.8 iron; for gas-tight metal-to-glass seals on radio tubes and similar applications.

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KROKOLOY—Detroit Alloy Steel Co., Detroit. Furnished in castings. chromium 12-14, carbon 1.5-1.6, cobalt 3-3.5, molybdenum .85-.90. Semiresistant to corrosion; heat to 1000 degrees Fahr.; abrasion resistance, high; tensile strength, ult., 125,000 lbs. per sq. in.; compressive strength, ult., 400,000 lbs. per sq. in.; medium ductility; good bearing and magnetic properties; used for high-speed bearings and cams, valve seats and spindles.

L

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LEDALOYL—Johnson Bronze Co., New Castle, Pa. Self-lubricating bearing bronze, pre-alloyed; contains lead which eliminates harshness and provides conformability for misalignment; combination of lead and graphite plus oil content make it useful where lubrication is remote or likely to be forgotten.

See advertisement, Page 6-D

LEDLOY STEELS—Inland Steel Co., Chicago. Lead-bearing, free-cutting, open-hearth steel; contains about one-quarter per cent lead, which increases machinability about 30-50 per cent and tool life approximately 50-200 per cent, but has no appreciable adverse effect on physical properties of the steel.

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LIGHTWELD—Lincoln Electric Co., Cleveland. Arc welding electrode made for fabrication of chain and gear guards and other machine parts of light gage steel.

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LO CRO .046—Crucible Steel Co. of America, New York. The following grades are used where high strength at elevated temperatures to 1200 degrees Fahr. is required.

Type 46; chromium 5.

Type 46MO; chromium 5, molybdenum .50.

Type 46 W; chromium 5, tungsten 1.

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LOTUS BABBITT—Lumen Bearing Co., Buffalo. Lead base bearing babbitt.

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LUBRICO—Buckeye Brass & Mfg. Co., Cleveland. Copper 75, lead 20, tin 5 per cent; for bearings, bushings and bars.

See advertisement, Page 11-D

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LUMEN ALLOYS—Lumen Bearing Co., Buffalo. (Note: "Lumen Alloy," together with each of the following numbers and grades, is a copyrighted term which should be used in specifying these materials. Thus, "Lumen Alloy No. OOA," etc.)

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Nos. 00A and 00C; high tin bronzes for high compression bearing applications.

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No. 1; zinc bronze for pressure castings including spur and bevel gears mating with steel.

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No. 2; zinc bronze for machine parts, bearings, etc.

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No. 3; zinc bronze for mine service and paper mill machinery and bearings.

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No. 4; phosphor bronze (leaded), for bearings.

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No. 4 chill cast; for heavy duty bearings, etc.

No. 4A; high phosphorus bronze (leaded), for bearings on hard steel.

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No. 5; general service casting alloy; red brass; for low pressure valve bodies, etc.

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No. 7; phosphor bronze; uses include trolley wheels and castings to be nickel or chromium plated.

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No. 9; manganese bronze for machine parts requiring strength, electrical conductivity, and high pressure.

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No. 11-C; (sand cast) aluminum bronze; for miter, bevel gears and bearings subject to impact.

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No. 11-C; (heat treated) tensile strength 65,000-100,000 lbs. per sq. in.; recommended where strength, corrosion and heat resistance are required.

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No. 14; zinc bronze, babbitt backing; for valve bodies, etc.

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No. 15; phosphor bronze; for worm wheels, bearings, etc.

No. 15 chill cast; for worm gears, nuts and bearings.

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No. 15A; phosphor bronze (slightly leaded); for worm wheels, bearings, etc.

No. 15-A chill cast; for heavy duty bearings and worm gear castings.

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No. 20; super-manganese bronze; for machine parts requiring extra strength.

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No. 27; (sand cast) aluminum bronze; for strength and corrosion resistance.

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No. 27; (heat treated) for extreme tensile strength and shock resistance.

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No. 31; for high-speed, low-duty bearings.

No. 33; for bearings, high speed, low duty.

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No. 48; nickel phosphor bronze; for bearings used with hardened steel, worm wheels, etc.

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

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No. 48 chill cast; for bearings, worm gears, nuts, slippers, etc.

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No. 54; phosphor bronze (leaded) for bearings and worm wheels for intermediate service.

No. 54 chill cast; for bearings, worm gears, nuts, etc.

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Old Genuine Babbitt; high strength ingot babbitt for bearings.

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Cosmo Babbitt; ingot material for bearings.

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Bronze; a zinc base alloy for bearings.

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LYNITE—Aluminum Co. of America, Pittsburgh. Aluminum wrought and casting alloys in the following grades: Nos. 43, 112, 113, 195, B195, 356, 14S, and A51S. Additional information on each of these grades will be found in listing ALCOA under the specific grade number.

M

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MACHEMPITE **"Wearprooft"** — Mackintosh-Hemphill Co., Pittsburgh. Alloy cast, forged or rolled steel; for gears, locomotive guides, track wheels, sprockets, conveyor parts, etc.

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MACHINEBRONZE—Lumen Bearing Co., Buffalo. Zinc bronze; cored and solid bars for bearings.

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MAGNOLIA—Magnolia Metal Co., Elizabeth, N. J.

Antifriction metal; lead-tin-antimony plus special fluxes, furnished in rough bars or billets and in ingots; tensile strength, ult., 15,000 lbs. per sq. in.; compressive strength, ult., 20,650 lbs. per sq. in.; bearing properties, good; brinell hardness, untreated 21.8; used for bearings.

Bronze bar stock; copper 80, tin 10, lead 10, and other alloys to suit conditions; furnished in cored bars; resists corrosion caused by acids; resists heat to 900 degrees Fahr.; tensile strength, ult., 31,500 lbs. per sq. in.; compressive strength, ult., 15,000 lbs. per sq. in.; bearing properties, good; brinell hardness, untreated 70; used for bearings.

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MAL-ARC—P. R. Mallory & Co. Inc., Indianapolis. A hard-facing material marketed in the form of an electrode; for application to machine parts where abrasion is encountered.

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MALLIX—National Malleable & Steel Castings Co., Cleveland. Pearlitic malleable iron; tensile strength 75,000 lbs. per sq. in., elongation 5 per cent; for grate bars for sintering machines, elevator buckets, screen plates for pan mills and other castings subjected to heat, abrasion and shock.

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MALLORY—P. R. Mallory & Co. Inc., Indianapolis.

- 2 - - - 6 7 - -

333 Metal; a copper-chromium-lithium alloy; used extensively for spot, flash and seam welding cold-rolled steel, stainless steel, nickel alloys and Monel metal, silicon bronze alloys, zinc, nickel, silver and other materials employed in applications where a high strength, high conductivity material is required.

- 2 - 4 - - 7 - -

53 Metal; copper base alloy furnished in rough and finished bars; tensile strength 90,000-100,000 lbs. per sq. in.; used for springs, washers, marine hardware, flash welding dies, bearings and current and heat-carrying members in electrical and other machinery.

73 Metal; rough and finished bars and sheets containing 95 per cent copper; resists sea water; 160,000-200,000 lbs. per sq. in. tensile strength; used for bearings and bushings, vibrator arms, springs, spring washers and electrodes for projection welding.

100 Metal; rough and finished bars containing 95 per cent copper; recommended for high loaded small gears, current-carrying bearings, springs and other details.

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MANGANO—Latrobe Electric Steel Co., Latrobe, Pa. Carbon .95, manganese 1.60, chromium .20; used where non-shrinking, oil quenching steel is required.

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MANGANWELD—Lincoln Electric Co., Cleveland. Arc welding electrode that produces deposit of austenitic manganese-nickel-molybdenum steel; suitable for hard facing austenitic manganese steel parts containing 11-14 per cent manganese, such as crusher parts, valves, turbine runners, pulverizer roll shafts, gathering and loading equipment.

Type B; a bare high-manganese electrode for building up worn manganese parts of the 11-14 per cent manganese type. Welds are air toughening and retain carbides in solution even on air cooling. Hardness, as deposited, 5-10 Rockwell C. Will rapidly cold work to hardness of 46-52 Rockwell C.

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MARTIN STEEL—Detroit Alloy Steel Co., Detroit. Furnished as castings. Chromium 12-14, carbon 1.5-1.6, cobalt 1.25, molybdenum 1.25; semiresistant; resists heat to 1000 degrees Fahr.; high abrasion resistance; tensile strength, ult., 115,000 lbs. per sq. in.; compressive strength, ult., 375,000 lbs. per sq. in.; medium ductility; good bearing and magnetic properties; brinell hardness, untreated 220, heat treated 600; for use as high speed bearings, cams, valve seats, spindles, etc.

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MASSILLON—Massillon Steel Casting Co., Massillon, O. Alloy cast steel, heat treated; for domestic, industrial and locomotive stoker worms.

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MAURATH—Maurath Inc., Cleveland. Alloy welding rods of many types; each type made especially for use with one of the leading varieties of stainless and heat-resisting steels and with coating of distinctive identifying color, also uncoated electrodes and those of special analyses.

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MAX-EL—Crucible Steel Co. of America, New York.

1-B; carbon .20, with high manganese and low molybdenum; excellent machining and uniformity in carburizing response; used for automobile parts, machine tool parts, gages, sprockets, etc.

3½; for heat treated parts on machine tools, such as gears, arbors, spindles, etc.

2-B; carbon .40, manganese 1; used in "as rolled" condition for machine tool spindles, lead screws, racks, worms, piston rods, etc.

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MAYARI—Bethlehem Steel Co. Inc., Bethlehem, Pa.

A; a nickel-chromium series of steels, corresponding to S.A.E. 31 XX series, suitable for heat-treated parts. Furnished in various carbon ranges for carburizing, water and oil-hardened parts.

B; a nickel-chromium steel furnished as bolts and sucker rods, having good atmospheric corrosion resistance combined with moderate strength, used in heat-treated condition.

R; a low-carbon, high-strength nickel-chromium-copper-phosphorus structural steel having good resistance to atmospheric corrosion. Used for structural purposes where weight reduction is desired.

XI; a nickel-chromium-vanadium steel furnished as sucker rods and having properties similar to Mayari B but having higher tensile strength and yield point with same ductility. Responds readily to normalizing without internal stresses.

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MAZLO Magnesium Alloys—American Magnesium Corp., Cleveland. Characteristics are light weight with mechanical strength and excellent machinability (2/3 that of aluminum); alkali resistant.

No. AM 240; 90 magnesium, 10 aluminum; furnished as sand castings and die castings; for parts of portable equipment and moving machinery where light weight and high strength is important.

No. AM 265; 6 aluminum, 3 zinc, balance magnesium; furnished as sand castings; for parts of portable equipment and moving machinery.

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No. AM 230; 10 aluminum, .5 silicon, balance magnesium; furnished as die castings; for moving parts and portable equipment.

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No. AM 57S; 6 aluminum, 1 zinc, balance magnesium; for use in the form of rods and tubes and for machinery where light weight is important.

No. AM 3S; 1.2 manganese, balance magnesium; furnished in sheets suitable for welding; for aircraft parts such as oil tanks, fuselage partitions and cowlings.

No. AM 58S; 8 aluminum, 1 zinc, balance magnesium; supplied as hot press forgings for highly stressed parts where lightness is important as in aircraft engine parts.

No. AM 65S; 3.5 aluminum, 5 tin, balance magnesium; for hot forged, stressed parts where light weight is important.

See advertisement, Page 47-D

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McGILL—McGill Mfg. Co., Valparaiso, Ind.

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No. 4 McGill bronze hydraulic pressure castings; finished casting tolerance of plus or minus .005.

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No. 1 McGill Metal; aluminum bronze alloy, suitable for pump liners, gears, corrosion resistant castings and parts requiring strength and toughness with minimum weight.

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MEEHANITE—Meehanite Metal Corp., Pittsburgh, and licensees as listed hereunder. A sorbo-pearlitic iron containing silicon, manganese, phosphorus, sulphur and carbon, composition depending upon mixture and physical constitution as determined by service requirements; twenty grades, some of which can be heat treated, each having a separate and distinct combination of physical properties; available in cast form; for machinery and miscellaneous castings.

Licensees include the following: American Brake Shoe & Fdy. Co., Mahwah, N. J.; Banner Iron Works, St. Louis; H. W. Butterworth & Sons Co., Bethayeres, Pa.; M. H. Detrick Co., Newark, N. J.; Farrel Birmingham Co., Ansonia, Conn.; Fleming Foundry Co., Springfield, Mass.; E. Long Ltd., Orillia, Ont.; General Electric Co., Ontario, Calif.; Valley Iron Works Inc., St. Paul; Greenlee Foundry Co., Chicago; American Laundry Machinery Co., Rochester, N. Y.; Cincinnati Milling Machine Co., Cincinnati; Cooper Bessemer Corp., Grove City, Pa., and Mt. Vernon, O.; Crawford & Doherty Foundry Co., Portland, Oreg.; Florence Pipe Foundry & Machine Co., Florence, N. J.; The Newark S'ove Co., Newark, O.; Fulton Foundry & Machine Co. Inc., Cleveland; General Foundry & Mfg. Co., Flint, Mich.; Stearns-Roger Mfg. Co., Denver, Colo.; Hamilton Foundry & Machine Co., Hamilton, O.; Kanawha Mfg. Co., Charleston, W. Va.; Barnett Foundry & Machine Co., Irvington, N. J.; Henry Perkins Co., Bridgewater, Mass.; Pohlman Foundry Co., Buffalo, N. Y.; Rosedale Foundry & Machine Co., Pittsburgh; Warren Foundry & Pipe Corp., Phillipsburg, N. J.; West Coast Meehanite Metal Corp., Los Angeles; Kinney Iron Works, Los Angeles; Koehring Co., Milwaukee; Marshall Stove Co., Lewisburg, Tenn.; Vulcan Foundry Co., Oakland, Calif.; Atlas Foundry Co., Detroit; Ross-Meehan Foundries, Chattanooga, Tenn.; Vancouver Engrg. Works, Vancouver, B. C.; Washington Iron Works, Seattle; Washington Machinery & Supply Co., Spokane, Wash.

See advertisement, Page 63-D

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METALINE—R. W. Rhoades Metaline Co. Inc., Long Island City, N. Y. Lubricating insert plugs of several diameters and lengths and in varied compositions for rendering bronze bearings and bushings oilless. Also bronze bearings complete in which Metaline plugs are inserted, furnished in form of finished bearings.

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MILL BRASS MIX—E. A. Williams & Son Inc., Jersey City, N. J. Bearings, bushings and mill brasses.

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MIN-OX—The Binney Castings Co., Toledo, O.

Type 51-C; available as sand castings; resists corrosion due to high temperature and oxidizing conditions; resists heat to 1400 degrees Fahr.; high abrasion resistance; tensile strength, 55,000 lbs. per sq. in.; good bearing properties; brinell hardness, untreated 220; used for glass molds, dies for tile pressing, oven enameling racks.

Type DV; available as sand castings; resists corrosion due to high temperatures and oxidizing conditions; resists heat to 1400 degrees Fahr.; tensile strength, 90,000 lbs. per sq. in.; good bearing properties; brinell hardness, untreated 250; used for glass molds, cams, and various machine parts.

Type JR-3; available as sand castings; resists corrosion due to high temperatures and oxidizing conditions; resists heat to 1200 degrees Fahr.; high abrasion resistance; tensile strength, 45,000 lbs. per sq. in.; good bearing properties; brinell hardness, 240; used for glass molds.

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MOCASCO 60—Motor Castings Co., Milwaukee. A dense, high-strength, machinable, nickel-chromium-molybdenum gray iron, A.S.T.M. No. 60; minimum tensile strength, 60,000 lbs. per sq. in.; brinell hardness, 228-260; recommended for gears, brake drums, refrigerator, hydraulic and pump castings, etc.

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MOGUL BABBITT—Federal-Mogul Corp., Detroit.

Mogul alloy genuine babbitt; made from tin, antimony and copper, virtually lead free; hard tough alloy; high tensile strength; suitable for die-cast and hand-poured bearings; used for high-speed automobile and aircraft engine, steel and bronze back main and connecting-rod bearings, trucks, tractors, high-speed machinery, planers, and crossheads.

Mogul bearing metal; general all-purpose babbitt for repair and maintenance; for bearings requiring toughness; used for machinery bearings, stationary gas engines, paper mill, rolling mill, rubber plant and brick machinery.

407 nickel babbitt; varying slightly from Mogul genuine babbitt alloy; for applications where speed is fairly high and bearings are large, that is 1/16-inch or more in thickness; used in woodworking machinery and other heavy duty types.

408 special babbitt (copper hardened); originally produced for electric railway armatures, now used for special bearing applications; has great durability and will stand up under hard wear; used in motor pumps, motor shafts, rock crushers and forming presses.

Duro antifriction metal; while softer and less tough than Mogul bearing metal (above), compares favorably with lead base general purpose babbits; used for flour mill, laundry, canning and bottling machinery, pump packing, slow moving pulleys and axle bearings.

Special "B"; a lead and antimony alloy; free of usual nonbearing ingredients; used for slow speed bearings of all kinds and heavy line shafting.

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MO-LYB-DEN-UM—Climax Molybdenum Co., New York. An alloying element for use in steel and iron; imparts strength, toughness, ductility and resistance to abrasion; improves fatigue value, eliminates temper embrittlement, increases physical properties at elevated temperatures; molybdenum steel is easily welded and machined.

See advertisement, Page 51-D

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MOLYBDENITE — Continental Roll & Steel Foundry Co., East Chicago, Ind. Special chrome molybdenum steel castings for mill pinions, guides and rolls.

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MOLYBDIE—A. Finkl & Sons Co., Chicago.

Type C; carbon .40, manganese .60, chromium .85, nickel 1.50, molybdenum .30, phosphorus and sulphur .04 max.; for machine parts subject to extreme torsional strains, shock and vibration, such as forging machine cranks, steam hammer piston rods, locomotive axles, crank pins and piston rods, rock crusher shafts, press crankshafts, etc.

Type R; carbon .31, manganese .55, chromium .75, nickel 1.50, molybdenum .30, phosphorus and sulphur .04 max.; uses are similar to above material.

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MONEL—International Nickel Co., Inc., New York.

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Type K; nickel 66, copper 29, iron .9, manganese .4, silicon .25, carbon .15, sulphur .005, aluminum 2.75; for parts requiring strength and corrosion resistance, and those which must be nonmagnetic.

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Type R; nickel 67, copper 30, iron 1.7, manganese 1.1, silicon .05, carbon .1, sulphur .035; recommended for screw machine products and other parts requiring high-speed machjning.

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Type H; nickel 66, copper 29.5, iron 1.5, silicon 3, manganese .9, carbon .1; nonmagnetic material for sand castings requiring strength, hardness and corrosion resistance.

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Type S; nickel 63, copper 30, iron 2, silicon 4, manganese .9, carbon .2; a corrosion-resistant, nonmagnetic material which makes sand castings of high hardness for resistance to abrasion and galling.

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Metal: composition of this alloy is nickel 67, copper 30, balance iron, manganese, silicon, carbon; general purpose alloy for use under corrosive conditions.

See advertisement, Page 13-D

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MORAINE—Moraine Products Div., General Motors Corp., Dayton, O. Rolled bronze split-type bearings and bushings for automobiles, electric motors and farm implements.

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MORGANITE—Morganite Brush Co. Inc., Long Island City, N. Y. Carbon-graphite, and carbon-graphite-metal mixtures; furnished in finished rods or bars and plates, for turning, boring, molding, etc.; resists corrosion caused by any liquid handled industrially; resists heat to 700 degrees Fahr.; good abrasion resistance; tensile strength, ult., 1000-3000 lbs. per sq. in.; compressive strength, ult., 10,000-30,000 lbs. per sq. in.; ductility, low; specific gravity 2-2.15; used for bearings, valves, seals, nonfriction slides, piston rings, etc.

See advertisement, Page 61-D

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MUELLER 600 BRONZE—Mueller Brass Co., Port Huron, Mich. Copper 60, zinc 35, other ingredients 5; for worm gears, connecting rods, seal rings for refrigerators, crankshafts for oil pumps, etc. Has high strength and heat resistance.

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MUMETAL — Allegheny Ludlum Steel Corp., Pittsburgh. Furnished in sheets, coiled strips and laminations for stamping, forming and drawing. Nickel 7.1-7.6, copper 4.5-6, chromium 2 max., balance iron. Has high permeability qualities; recommended heat treatment, 1800-2000 degrees Fahr.; used for audio-transformers, sensitive relays and electrical instruments.

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MUNTZ METAL—American Brass Co., Waterbury, Conn., and Chase Brass & Copper Co., Waterbury, Conn. Copper 60, zinc 40; in sheet and tube form.

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MUREX—Metal & Thermit Corp., New York. A series of welding electrodes designed for welding carbon-molybdenum steel, U.S.S. Cor-Ten, Mayari and similar steels.

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NA, NA-1, NA-2—National Alloy Steel Division, Blawnox, Pa. Varying percentages of nickel and chromium.

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NACO—National Malleable & Steel Castings Co., Cleveland. Specially processed cast steel for service where heavy blows and constant friction require a material that combines great strength, toughness and resistance to wear; used in chains for steam shovel, dragline and draft gears, railway equipment, etc.

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NICHROME—Driver-Harris Co., Harrison, N. J. Acid and alkali, heat resistant alloy consisting of nickel 60, iron 25, chromium 15; resists heat to 2000 degrees Fahr.; recommended for furnace parts, acid dipping baskets, and filter screen.

Type A; nickel 62, chromium 15; heating element material; also for electrical devices including rheostats, potentiometers, seamless tubing, etc.

Type B; as an addition to cast iron; sold in ratios of 5 and 2½ parts of nickel to 1 part of chromium.

Type V; nickel 80, chromium 20; heating element material; also in sheets for welded tubing, etc.

Cast Nichrome; for furnace parts, pyrometer protection tubes, conveyor castings and carburizing containers. Sheet Nichrome S; sheet; nickel 27, chromium 15, used for various applications.

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NICKEL—International Nickel Co. Inc., New York.

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Type A; nickel 99.4, copper .1, iron .15, manganese .2, silicon .05, carbon .1, sulphur .005; a corrosion resistant material which resists heat.

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Type D; nickel 95.2, copper .05, iron .15, manganese 4.4, silicon .05, carbon .1, sulphur .005; furnished in rods, tubing and wire; suitable for parts which must resist effects of products of combustion of gasoline and other fuels at high temperatures.

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Type Z; furnished in rods, wire and strips; suitable for use where exceptional high strength and corrosion resistance are demanded.

See advertisement, Page 13-D

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NICKELOID—American Nickeloid Co., Peru, Ill. Nickel bonded to zinc, latter serving as rust-proof, flexible and inexpensive white metal base. Available in variety of brilliant finishes and patterns, as sheets, flat strips and coiled strip for continuous feed automatic presses. Can be supplied with quick removable, gum-adhered paper covering permitting drawing and forming without marring pre-finish. For tube clips, toys, automotive details and stamped and formed parts demanding bright, permanent finish.

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NICRAL — Nicralumin Co., Wilmington, Del. Complete series of light aluminum alloys in various forms and tempers.

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NICUITE—A. W. Cadman Mfg. Co., Pittsburgh. Nickel bronze; tin 10, nickel 3.5, zinc 2.5, trace of phosphorus, balance copper; high compressive strength for slow or medium speed operation under extreme load pressures.

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NI-HARD—International Nickel Co. Inc., New York, and licensees. Nickel 4.5, chromium 1.5, total carbon 2.7-3.6; cast iron for chilled rolls, cement grinding balls, etc., where abrasion is encountered.

See advertisement, Page 13-D

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NILVAR—Driver-Harris Co., Harrison, N. J. A 36 per cent nickel steel having the lowest coefficient of expansion to 392 degrees Fahr. of an alloy; used for thermostatic controls in heating apparatus such as electric ovens, laboratory ovens, gas ovens, oil burners, and house heating apparatus.

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NIPERMAG — Cinaudagraph Corp., Stamford, Conn. Nickel-aluminum-iron alloy furnished as sand castings; resists corrosion; specific

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

gravity, 7; fair weldability; hardness on Rockwell C scale from 48-53, variable on account of crystal structure; for permanent magnets only.

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NI-RESIST—International Nickel Co. Inc., New York and licensees. Nickel 14, copper 6, chromium 2, total carbon 2.75-3.10, silicon 1.25-2, manganese 1-1.5; for castings handling corrosive waters and other solutions, or heats above the range of temperature where ordinary cast iron gives good service; resists corrosive vapors, gases and liquids; recommended instead of plain cast iron under such conditions.

See advertisement, Page 13-D

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NIREX—Driver-Harris Co., Harrison, N. J. Acid-resisting material with tensile strength, annealed, up to 95,000 lbs. per sq. in.; spring temper 180,000; supplied in finished rods or bars, wire, sheets and strip; also can be fabricated by sand casting; for use where corrosion and heat resistance, and spring properties will be useful.

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NI-TENSYLIRON—International Nickel Co. Inc., New York, and licensees. Nickel 1-4, total carbon 2.50-3.15, silicon 1.20-2.75, manganese .5-.9; for machine tool castings, diesel engine housings, auto cylinder blocks, pistons, etc.

See advertisement, Page 13-D

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NITRALLOY—Nitralloy Corp., New York, controls nitriding process and licenses under which alloy is produced. A chromium-molybdenum-aluminum steel capable of developing extreme hardness through nitriding; for cams and camshafts, gears, pump parts, splined shafts, cylinder liners, etc. Licensees include Bethlehem Steel Co., Crucible Steel Co. of America, Firth-Sterling Steel Co., Allegheny Ludlum Steel Corp., Vanadium-Alloys Steel Co., Republic Steel Corp., Lebanon Steel Foundry, Empire Steel Castings Co., Massillon Steel Castings Co., Milwaukee Steel Foundry Co., Warman Steel Castings Co., Simonds Saw & Steel Co., Timken Roller Bearing Co.

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NITRICASTIRON — Nitricastiron Corp., New York. A cast iron of special compositions for surface hardening by nitriding process; for engine cylinder liners, pump and compressor liners, bushings, oil well equipment, airplane, automotive, tractor and machine tool parts. Licensees are Arcade Malleable Iron Co., Worcester, Mass., Forging & Casting Corp., Ferndale, Mich., Hunt-Spiller Mfg. Corp., South Boston, Mass., and Allegheny Ludlum Steel Co., Watervliet, N. Y.

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NUREX—National Malleable & Steel Castings Co., Cleveland. A chromium-manganese-carbon alloy furnished in castings; resists corrosion caused by dilute aqueous solutions and acids (except phosphoric); resists heat to 1700 degrees Fahr.; abrasion resistance, high; ductility, low; used for mill balls, lining and similar purposes.

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OHMALOY — Allegheny Ludlum Steel Corp., Pittsburgh. Furnished in sheets, coiled strip, wire and rods, for stamping, turning and boring. Chromium 12-14, aluminum 4-4.75, balance iron. Has high electrical resistivity; magnetic properties moderate; resists oxidation to 1600 degrees Fahr. Anneals at 1350-1450 degrees Fahr. Used for electrical resistor grids and wire wound resistors, also edge-wound strip resistor.

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OILITE—Chrysler Corp. Amplex Div., Detroit, Mich. Oil cushion, heavy-duty bronze bearings containing one-third oil by volume; used extensively in automobiles, airplanes, farm implements, textile machinery, conveyors, air conditioners, machine tools, household equipment, electric motors, pumps, special machinery, clocks, etc.

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OLYMPIC BRONZE—Chase Brass & Copper Co. Inc., Waterbury, Conn.

Type A; copper 96, silicon 3, zinc 1; tensile strength, 55,000-150,000 lbs. per sq. in.; brinell hardness 70-200; annealed at 1100-1200 degrees Fahr. if necessary to soften for additional cold working; resists corrosion due to saline, acid and alkaline solutions; used for welded structural parts, bolts, nuts, tubing, tie rods, etc.

Type B; copper 97.5, silicon 1.5, zinc 1; tensile strength, 45,000-90,000 lbs. per sq. in.; annealed at 1100-1200 degrees Fahr. if necessary to soften for additional cold working; resists corrosion due to saline, acid and alkaline solutions; used for bolts, nuts, pipe and tubing.

Type C; copper 94.75, silicon 4.25, zinc 1; for sand castings; tensile strength, 40,000-50,000 lbs. per sq. in.; brinell hardness 85; resists corrosion due to saline, acid and alkaline solutions; used for corrosion resistant castings.

Type D; copper 95.6, silicon 3.0, zinc 1, lead .4; physical properties same as type "A"; a free-machining alloy recommended for bolts, nuts and screw machine parts.

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OREIDE—Scovill Mfg. Co., Waterbury, Conn. Copper 90, tin .5, balance zinc; furnished in finished rods or bars, tubing, wire, sheets and strips (coiled); for stamping, turning, boring, etc., into machine parts; medium abrasion resistance; tensile strength, 95,000 lbs. per sq. in. (hard drawn or rolled); specific gravity, 8.8; bearing properties fair; electrical properties fair; recommended heat treatments, anneal at 525-550 degrees Cent.; spring properties good; used primarily for spring contacts and switch parts.

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OXWELD—Linde Air Products Co., New York.

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No. 1; welding rod for steel giving welds of high tensile strength.

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No. 7; chrome iron welding rod giving welds of high tensile strength.

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No. 23; welding rod for aluminum giving corrosion resistance and high tensile strength.

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No. 25M; bronze welding rod having brinell hardness of 96 and tensile strength of 55,000 lbs. per sq. in.

No. 28; a columbium bearing welding rod suitable for 18-8 stainless steel.

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PAINTGRIP—American Rolling Mill Co., Middletown, O. Galvanized sheet iron or steel with special bonderized surface integral with zinc coating; for immediate painting after fabrication. Obviates acid etching or weathering. Phosphate film neutral to paint and extends paint life, greatly retarding flaking and peeling.

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PERDURO—The Jeffrey Mfg. Co., Columbus, O. High-strength malleable iron for sand casting; resists corrosion due to analysis and heat treatment; resists heat to 1100 degrees Fahr.; high abrasion resistance; tensile strength, 80,000 lbs. per sq. in.; used for cast chains for drive and conveyor service.

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PERMITE—Aluminum Industries Inc., Cincinnati. Following grades available as sand castings, gravity die castings and ingots.

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No. 1002; copper 10, iron 1.50, magnesium 40, balance aluminum; for pistons for automotive, pump and refrigeration service.

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No. 1010; copper 4, silicon 1, balance aluminum; for machine parts to resist shock; heat treatment is to soak at critical and quench in water, and reheat at 350 degrees Fahr. to desired properties.

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No. 1019; furnished in ingots and sand castings; silicon 5, copper 1.25, magnesium .50, balance aluminum; heat treatment, quenching in water; suitable for highly stressed parts including airplane engine parts.

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No. 2011; silicon 5, balance aluminum; for parts subject to atmospheric corrosion.

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No. 2021; magnesium 4, balance aluminum; for parts subject to salt water corrosion.

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PHOS-COPPER—Westinghouse Electric & Mfg. Co., East Pittsburgh. Rod and strip material containing 5 phosphorus and balance copper; highly corrosion resistant; gives strong joints when brazing assemblies of copper and copper alloys to each other.

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PIONEER METAL—Pioneer Alloy Products Co. Inc., Cleveland. Approximately 65 nickel, chrome and molybdenum; castings; readily machinable; resists corrosion caused by sulfuric, nitric and phosphoric acid; resists heat to 2000 degrees Fahr.; tensile strength, ult., 74,000 lbs. per sq. in.; weldability, good; for valve and pump parts.

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PLATINUMCLAD—Baker & Co. Inc., Newark, N. J. Pure platinum welded to various base metals, furnished in tubing and wire. Resists corrosion caused by usual acids; medium abrasion resistance; good weldability; tensile strength, ductility, etc., are dependent upon properties of base metals. Used for tubing exposed to acids and for vessels subject to same.

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PMG METAL—Phelps Dodge Copper Products Corp., New York. High-tensile silicon bronze having high strength and hardness, low coefficient of friction, resistance to impact, etc.; produced in form of rods, wire, tubing, strip, sheet, sand castings, die castings and centrifugal castings; used for pump shafting, rods, bolts, nuts and rivets, valve parts, gears, bearings, spindles and rigid conduit and electrical metallic tubing.

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POMPTON—Allegheny Ludlum Steel Corp., Pittsburgh. Carbon .95-1.05; for arbors, bushings, collets and lathe centers. Water hardening.

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PRECISION—Precision Castings Co. Inc., Syracuse, N. Y.

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Type A-12; aluminum base alloy; silicon 12, balance aluminum; resists heat to 1000 degrees Fahr., tensile strength, 33,000 lbs. per sq. in.; specific gravity, 2.66; for general aluminum die casting uses.

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Type ZN-5; aluminum 4, copper 1, magnesium .04, balance zinc; tensile strength, 42,000 lbs. per sq. in.; compressive strength, 85,000; specific gravity, 6.71; brinell hardness, 75; for general die casting uses—automotive, washing machines, electrical equipment, etc.

Type ZN-6; aluminum 4, magnesium .04, balance zinc; tensile strength, 36,000 lbs. per sq. in.; compressive strength, 60,000; specific gravity, 6.60; brinell hardness, 65; for automotive and electrical equipment, washing machines, and miscellaneous mechanical parts.

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A-50; silicon 5, balance aluminum; furnished as castings; resists corrosion caused by atmosphere, foods, etc., resists heat to 1000 degrees Fahr.; abrasion resistance, medium; tensile strength, ult., 29,000 lbs. per sq. in.; ductility, medium; for use where corrosion resistance and ductility are essential.

A-54; silicon 5, copper 4, balance aluminum; furnished as castings; resists corrosion caused by atmosphere; resists heat to 1000 degrees Fahr.; tensile strength, ult., 32,000 lbs. per sq. in.; brinell hardness, untreated 75; general aluminum die cast parts.

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PREMIER BABBITT—Empire Metal Co., Syracuse, N. Y. Tin 84, antimony 9, copper 7, all virgin metals, phosphorized. Resists corrosion caused by oil and atmospheric acids; resists heat to 900 degrees Fahr.; tensile strength, ult., 17,600 lbs. per sq. in.; compressive strength, ult., 6600 lbs. per sq. in.; high ductility; used for bearings on high-speed presses.

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PROFERALL — Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich. Electric furnace high test cast iron, low carbon;

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

chrome nickel molybdenum alloyed; furnished in two grades, 3-X and 5-X; for crankshafts and camshaft castings, high strength, heat resisting castings, hydraulic press and pressure castings, etc.

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PROMAL—Link-Belt Co., Indianapolis. Specially processed malleable iron; will withstand heavy loads without permanent distortion; where additional corrosion resisting properties are desired small percentages of copper can be added; can be hot-dip galvanized and will withstand repeated heating and cooling without growing brittle; uses include chain links, bearing caps, rocker arms, gears, sheaves, levers, and other machine parts subjected to severe service.

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PYRASTEEL—Chicago Steel Foundry Co., Chicago. Nickel varies from 8 per cent up, chrome from 8-26 per cent; available as castings for heat treating furnaces, screw conveyors, or any high temperature service to 2200 degrees Fahr. Also available in following grades: No. 20, nickel 35, chrome 18; No. 18, nickel 25, chrome 16; No. 2000, chrome 26-28, nickel 14; No. 14 chrome 6, molybdenum .5. All of these grades carry a high silicon content, varying from 1-2.5 per cent.

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PYRODIE—Heppenstall Co., Pittsburgh. Nickel chrome-molybdenum-steel, .6 carbon; for insert and hot die steel service.

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PYTHON—Allegheny Ludlum Steel Corp., Pittsburgh. Carbon .85, vanadium .25; for chuck jaws, clutch pins and other parts requiring unusual wear and shock resistance. Water hardening.

Q

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Q-ALLOYS—General Alloys Co., Boston.

CN-1; chrome 22-26; nickel 10-12; resists corrosion due to attack from most all common acids and gases; brinell hardness 160-200 untreated; resists heat to 2100 degrees Fahr.; tensile strength, 75,000-95,000 lbs. per sq. in.; used for machine parts where corrosion resistance is desired.

CN-2; chrome 17-21, nickel 7-9; resists general corrosion; brinell hardness, 160-200 untreated, 160-200 heat treated; resists heat to 2100 degrees Fahr.; tensile strength, 70,000-80,000 lbs. per sq. in.; same use as above.

CN1-H; resists heat and corrosion; tensile strength, 80,000 lbs. per sq. in.; for castings subject to temperatures to 2100 degrees Fahr.

CN1-MO; same data as for CN-1, except that it contains 1-4 per cent molybdenum.

CN2-MO; same data as for CN-2, except that it contains 1-4 per cent molybdenum.

Chrome C1; chrome 25-30, nickel 3 max.; resists corrosion caused by mine water.

Chrome C2; resists corrosion caused by nitric acid; used for machine parts where corrosion resistance is desired.

Chrome C3; resists heat to 2000 degrees Fahr.; brinell hardness over 500 untreated; used for mill guides and any part requiring resistance to abrasion at high temperatures.

Grade A; resists heat to 2200 degrees Fahr.; nickel 65-68, chrome 15-19; tensile strength approximately 70,000-80,000 lbs. per sq. in.; annealing to remove casting stresses only; for machine parts requiring high temperatures to 2200 degrees Fahr.

Grade B; approximately 60 nickel, 12 chromium; resists heat to 2200 degrees Fahr.; tensile strength, approximately 65,000-75,000 lbs. per sq. in.; for use where temperatures to 2200 degrees Fahr. are required.

R

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RANDALL—Randall Graphite Products Corp., Chicago. S.A.E. No. 64 bronze or as specified; furnished as sand castings; resists corrosion caused by moisture; resists heat to 700 degrees Fahr.; high abrasion resistance; tensile strength, ult., 30,000 lbs. per sq. in.; medium ductility; good bearing properties; conductivity, good; brinell hardness. untreated 80; for use as bushings; graphite-inserted in the perforated or drilled hole, grooved, or reservoir types.

See advertisement, Page 57-D

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READYWELD—Lincoln Electric Co., Cleveland. Welding electrode for use with alternating current transformer type welders which have low open-circuit voltage. Possesses arc stability with easy re-striking. For general welding work on light gage sheet steel.

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RED ANCHOR—Anchor Drawn Steel Co., Latrobe, Pa. Carbon .95-1.1; commercial carbon drill rods; for precision shafts for motors, spindles, anvils and dental tools.

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RELLEUM BRASS—Mueller Brass Co., Port Huron, Mich. Copper 59, lead 2, zinc 31; recommended for forged brass parts.

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REPUBLIC—Alloy Steel Div., Republic Steel Corp., Massillon, O. These alloy steels meet demands for material of lighter weight, greater strength, resistance to shock, impact and torsional strain, and high fatigue resistance; for severe service.

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RESISTO-LOY—Resisto-Loy Co., Grand Rapids, Mich. Chromium 24.5, molybdenum 8.5, copper 1, carbon 3, silicon 1; furnished as welding rods and electrodes; resists corrosion caused by acid and alkali; resists heat to 1000 degrees Fahr.; abrasion resistance, high; tensile strength, ult., 90,000 lbs. per sq. in.; compressive strength, ult., 186,000 lbs. per sq. in.; bearing properties, good; brinell hardness, untreated 610; for use where shock and abrasion resistant parts are required.

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REX Z METAL—Chain Belt Co., Milwaukee. Furnished as castings; resists corrosion caused by weather and inorganic acids to a degree; resists heat to 1100 degrees Fahr.; high abrasion resistance; tensile strength, ult., 80,000 lbs. per sq. in.; medium ductility; specific gravity, 7.45; good bearing properties; brinell hardness, untreated 200; for cast parts requiring high strength and good machinability.

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REZISTAL—Crucible Steel Co. of America, New York.

Stainless irons; No. 12; 10-14 chromium. No. 17; 14-18 chromium. No. 20; 18-23 chromium. No. 27; 23-30 chromium. No. 162; 16 chromium, 2 nickel. No. 182; 18 chromium, 2 nickel. All foregoing have .12 max. carbon, except No. 20 and 27 which have carbon .25 max.

Stainless steels; a group similar to the foregoing except having a higher carbon content; used principally for bearings, cutlery, etc., where hardness and resistance to corrosion are desired.

Stainless A; .3 carbon, 12 chromium. B; .6 carbon, 16 chromium. B-100; 1 carbon, 17 chromium.

KA-2 (chromium 18, nickel 8 min., carbon .08 max.) and its modifications. No. 3; chromium 2, nickel 12. No. 4; chromium 20, nickel 25, silicon 2.5. No. 7; chromium 25, nickel 20. No. 2600; chromium 8, nickel 22.

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RITA—Cannon-Stein Steel Corp., Syracuse, N. Y.

No. 2; carbon .2, manganese 1.15, phosphorus and sulphur .05 max., nickel .5, chromium .3; brinell hardness, untreated 174, heat treated 388; carburizing 1650 degrees Fahr. and for toughening at 1550-1575 degrees Fahr.; resists corrosion due to chromium and nickel content; resists heat of 500-600 degrees Fahr.; tensile strength, 85,000 lbs. per sq. in. as rolled; for general machinery purposes where a free-cutting uniform material of great strength and toughness is desired.

No. 4; carbon .4, manganese .9, phosphorus and sulphur .08, chromium and nickel .5 max., brinell hardness, untreated 223, heat treated 461; recommended heat treatment, oil quenching, 1475 degrees Fahr.; resists corrosion due to chromium and nickel content, resists heat to 900 degrees Fahr.; tensile strength 105,000 lbs. per sq. in. as rolled. Recommended for spindles and shafts, toughness being reduced to render more readily machinable.

No. 5; carbon .5, manganese 1.2, phosphorus and sulphur .05 max., nickel .5 max., chromium .6; brinell hardness, untreated 269, heat treated 627, recommended heat treatment for oil quenching is 1500-1525 degrees Fahr.; resists corrosion due to chromium and nickel content; resists heat of 900-1000 degrees Fahr.; tensile strength, 130,000 lbs. per sq. in. as rolled; for gears, jaws, studs, bolts, axles, etc.

No. 7; carbon .65, manganese .5, phosphorus .045 max., sulphur .05 max., chromium .6, nickel 1.25; brinell hardness, untreated 179-223, heat treated 653; recommended heat treatment, water quenched, at 1425-1450 degrees Fahr.; oil quenched, at 1450-1475 degrees Fahr. Resists corrosion due to nickel and chromium content; resists heat of 700-800 degrees Fahr.; tensile strength, 135,000 lbs. per sq. in. as rolled; for expander and dowel pins, vise and wrench jaws, pneumatic hammer pistons, etc.

1 - - 4 - - 7 - -

RIVERSIDE—Riverside Metal Co., Riverside, N. J.

Beryllium copper; heat treatable copper alloy; has high tensile strength and ductility; for electrical parts, springs, diaphragms, jet tips, valve sleeves and seats, etc.

Phosphor bronze; copper tin alloy to which phosphorus has been added; has high strength and ductility; used in electrical appliances and machinery as springs, bearings, diaphragms, textile ring travelers, etc.

Nickel silver; copper, nickel, zinc in varying proportions; for diaphragms, radio and telephone springs, screw machine products, etc.

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ROL-MAN—Manganese Steel Forge Co., Philadelphia. Furnished in rods or bars, wire, sheets and plates, also hot forgings, stampings, wire cloth, welded and ground parts; contains manganese 11-14; carbon 1.1-1.4; resists heat to 400 degrees Fahr.; has high abrasion resistance; tensile strength, 140,000-160,000 lbs. per sq. in.; compressive strength 100,000; high ductility; nonmagnetic; brinell hardness, heat treated 190-210; used where parts are subject to severe abrasion and need high strength.

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ROMAN BRONZE—Revere Copper & Brass Inc., New York. Copper 60, tin .75, zinc 39.25; for forging, flanging, upsetting; uses include piston rods, shafting, bearing applications, etc.

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RUSTLESS—Rustless Iron & Steel Corp., Baltimore.

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13-HC-35, type 420; carbon .4 max., chromium 12-14; hardening type of stainless steel; brinell hardness 550; used for valve parts, knife blades, abrasion and corrosion resisting machine parts.

17-HC-60 and 90, type 440; carbon .6-1.1, chromium 14-18; hardening type of stainless steel; brinell hardness 625; used for same type of machine parts as type 420.

1 2 - 4 - - - - -

25-12, type 309; carbon .2 max., chromium 22-26; nickel 12-14; highly resistant to heat and creep to 1300 degrees Fahr., scaling to 2000 degrees Fahr.; resists nitric-sulphuric acid mixtures and sulphite liquors; used for furnace parts and for parts where corrosion conditions are severe.

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RUSTLESS 17—Rustless Iron & Steel Corp., Baltimore.

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Type 430; carbon .12 max. and chromium 14-18; resists sulphur gases, nitric, and organic acids; nonhardenable; for corrosion resisting rivets, screws, bolts and other parts.

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Type 430F; carbon .12 max., sulphur .15 min. and chromium 14-18; free-cutting stainless steel which resists heat to 1450 degrees Fahr.; tensile strength 100,000 lbs. per sq. in.

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

S

1 2 - - - 6 - - -

SABECO—Fredericksen Co., Saginaw, Mich.

No. 5 bearing bronze; copper 69-71, tin 4.5-5.5, lead 24-26, max., impurities .2; for light or medium load and water lubricated bearings.

No. 9; copper 69-71, tin 8.5-9.5, lead 20-22, max., impurities .2; for heavy loads such as average machine tool requirements.

No. 11; copper 69-71, tin 10.5-11.5, lead 18-20, max. impurities .2; for extra heavy unit pressures.

No. 11HG; copper 69-71, tin 10.5-11.5, lead 18-20, max. impurities .2; for worm wheels, clutch shifter shoes, forging machine slides, and extreme heavy bearing conditions.

No. 16; copper 69-71, tin 15-16.5, lead 13.5-14.5, max. impurities .2; for friction rings, and heavy duty boring spindle bearings.

1 - 3 4 - - - - - -

SANDUSKY ALLOY IRON—Sandusky Foundry & Machine Co., Sandusky, O. Nickel, chrome and molybdenum cast iron alloys; furnished in tubing, centrifugally cast and in finished cylindrical parts; resists corrosion; high abrasion resistance; tensile strength 25,000-60,000 lbs. per sq. in.; brinell hardness, untreated, 160-300; heat treated, 300-600; used for rolls, liners, sleeves, bushings, cylinders, pipes and tubes.

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SANDUSKY BRONZES—Sandusky Foundry & Machine Co., Sandusky, O. Bronze, brass and manganese bronze alloys; furnished in tubing, centrifugally cast and in finished cylindrical products; resists corrosion due to composition and superior structure; tensile strength 30,000-110,000 lbs. per sq. in.; good bearing properties; brinell hardness, untreated, 40-250; used for rolls, liners, sleeves, bushings, cylinders, pipe, tubes of 3-46 inches in diameter and 330 inches in length.

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SCOVILL—Scovill Mfg. Co., Waterbury, Conn. A complete line of high and low brasses, phosphor bronzes, nickel silvers, and cupro nickels for various mechanical, electrical and heat-exchanger purposes.

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SCOVILL FREE-CUTTING BRASS ROD—Scovill Mfg. Co., Waterbury, Conn. Copper 61, lead 3, zinc 36; furnished in finished rods or bars, for hot forging, turning, boring, etc. Resists heat to 500 degrees Fahr.; abrasion resistance, medium; tensile strength, ult., 55,000-75,000 lbs. per sq. in.; ductility, medium; specific gravity, 8.5; bearing properties, fair. Specially adapted to fabricating on high speed screw machines.

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SCOVILL HARDWARE BRONZE—Scovill Mfg. Co., Waterbury, Conn. Copper 89, lead 2, nickel 1, balance zinc; furnished in rods, bars and wire for turning, boring, etc.; machinability good; resists corrosion caused by atmospheric conditions; tensile strength, 38,000-85,000 lbs. per sq. in.; specific gravity, 8.85; bearing properties good; recommended heat treatment, annealing, 1000-1100 deg. Fahr.; brinell hardness, untreated, 48-125; used for hardware and screw machine products.

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SCOVILL NAVAL BRASS—Scovill Mfg. Co., Waterbury, Conn. Copper 60, tin .75, zinc 39.25; furnished in finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. Resists heat to 500 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 60,000-90,000 lbs. per sq. in.; ductility, medium; weldability, fair; specific gravity, 8.4. Used for boat shafting, turn buckles, welding rod, etc.

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SEMINOLE—Allegheny Ludlum Steel Corp., Pittsburgh. Carbon .45, chromium 1.3, tungsten 2, vanadium .25; for high creep strength bolts and studs for superheated steam; also machine parts having high wear and fatigue values. Withstands moderately elevated temperatures (to 110 degrees Fahr.). Oil hardening.

1 - 3 4 5 6 - - -

SEYMOUR—Seymour Mfg. Co., Seymour, Conn. Nickel silver, grade A; nickel base alloy which is corrosion resistant and has a tensile strength to 100,000 lbs. per sq. in.

1 - 3 - - 6 - - -

Phosphor bronze, Grade A; brinell hardness 160 and tensile strength 105,000 lbs. per sq. in.

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Phosphor bronze, grade C; brinell hardness 175; tensile strength 112,000 lbs. per sq. in.

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SEYMOURITE—Seymour Mfg. Co., Seymour, Conn. Copper 64, nickel 18, zinc 18; furnished in rough bars or billets, finished rods or bars, wire, sheets, strips (coiled), and plates, for sand casting stamping, turning, boring, and welding; specific gravity, 8.75; ductility, high. Used in electrical equipment.

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SHENANGO-PENN—Shenango-Penn Mold Co., Dover, O. Centrifugal castings in all bronzes, Monel metals and alloy irons; used for bearings, bushings, drums, liners, roll covers, sleeves, washers, rings, etc.

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SHIELD-ARC—Lincoln Electric Co., Cleveland. Type 85; high tensile welding rod; recommended for fabrication of high tensile steels; brinell 190-250.

Type 100; brinell hardness 235-300.

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SHOCK PROOF—Lake City Malleable Co., Cleveland. Malleable iron of high tensile strength, high yield point and ability to withstand considerable shock loading and abuse, at the same time possessing good machining qualities; for cast parts to resist heavy strains, shocks and corrosion.

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SICROMO—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.

1 2 - - - - - - - -

Type 1; carbon .15 max., manganese .5 max., phosphorus .03 max., sulphur .03 max., silicon 1-1.4, chromium .75-1.25, molybdenum .45-.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc. Material is corrosion resistant; heat resistant to 1050 degrees Fahr.; tensile strength, ult., 60,000 lbs. per sq. in., min.; fair weldability; and brinell hardness, annealed 163 max. For use in oil refinery field.

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Type 2; similar to above with slightly more chromium content.

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Type 2½; similar to Type 2 with slightly different silicon content.

Type 3; similar to Type 2½, with slightly higher silicon and chromium content.

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Type 5; similar to Type 3, with lower silicon content and more chromium.

Type 5S; similar to Type 5, differing only in higher silicon content.

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Type 7; similar to Type 5S, having lower silicon and higher chromium content.

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Type 9; similar to Type 7, having higher chromium content. All above materials are for oil refinery use.

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SIL-FOS—Handy & Harman, New York. Brazing alloy containing silver 15, copper 80, phosphorus 5; furnished in rods, wire, sheets and strips (coiled); corrosion resistant; high ductility; specific gravity 8.45; used to join nonferrous metals only, particularly copper, brass and bronze.

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SILFRAM—Stoody Co., Whittier, Calif. A hard-facing metal designed for application to parts subjected to corrosion, abrasion and impact.

1 2 - - - - - - - -

SILMO—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon .15 max., manganese .5 max., phosphorus .04 max., sulphur .045 max., silicon 1.15-1.65, and molybdenum .45-.65; furnished in rough bars or billets, finished rods or bars, and tubing, for hot forging, welding, turning, boring, etc., into parts. Tensile strength, ult., 55,000 lbs. per sq. in. min.; resists heat to 1000 degrees Fahr.; fair weldability; brinell hardness, annealed 163 max. For use in oil refinery field.

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SIL-TEN—United States Steel Corp. and subsidiaries (See USS). Carbon .4 max., manganese .6 min., silicon .2 min.; used in the design of machinery.

See advertisements, Pages 5-D—53-D

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SIMPLEX—Crucible Steel Co. of America, New York. Nickel 1.25, chromium .75; forging steel for machine parts requiring high strength and toughness; also available in case carburizing type.

1 2 3 4 5 - 7 - -

SIVYER—Sivyer Steel Castings Co., Milwaukee.

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"Sixty"; chromium 18, nickel 8, carbon .12 max.; an austenitic nonhardenable corrosion resistant cast steel; also non-magnetic.

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"Sixty-four"; chromium 27, nickel 10, carbon .25 max.; characterized by high strength and better corrosion resistance than "Sixty."

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"Sixty-six"; chromium 11.5-13.5, carbon .12 max.; hardenable cast steel of medium corrosion resistance.

Five per cent chrome moly—a 5 per cent chromium, .5 molybdenum steel, for oil refinery and power plant service.

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"Seventy"; chromium 15, nickel 35.

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Hi-carbon chrome-moly; a 70 per cent chrome molybdenum air hardening cast steel for severe abrasion; for rolling mill rolls, wearing plates, etc.

6140; fine grained cast chrome vanadium steel for road machinery or excavator teeth, etc., combining abrasion resistance with good ductility.

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3140; chrome-nickel general purpose steel; composition properly balanced for liquid quenching.

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Manganese nickel; manganese 1.2, nickel .75 suitable for differential water quenching.

Manganese vanadium; manganese 1.25, vanadium .1; cast steel with combination of strength and ductility.

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Dynamo; a low carbon, low manganese steel with low residual magnetism.

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STAINWELD—Lincoln Electric Co., Cleveland. Coated electrode for welding stainless steels or building up surfaces to resist corrosion.

Type A; for large number of so-called 18-8 stainless steels. Welds are of high tensile strength and ductility and possess same resistant qualities as the parent metal. Contains suitable amount of columbium to prevent intergranular corrosion of deposited metal.

Type B; for arc welding stainless steel with chemical content of approximately 25 per cent chromium and 12 per cent nickel. Physical properties equal to metal welded.

Type C; a modification of the well-known 18-8 analysis, commonly known as 18-8 SMO (approx. 3½ molybdenum). Suitable for welding stainless steels of types 316-317 (Iron and Steel institute).

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STANDARD-ALLOY—Standard Alloy Co., Cleveland. Nickel 20-60, chromium 16-25; for heat and acid resisting castings.

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STANNUM BABBITT—Lumen Bearing Co., Buffalo. Tin base bearing babbitt.

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STEELBOND—Johnson Bronze Co., New Castle, Pa. Bronze on steel in finished bearings; resists heat to 170 degrees Fahr.; medium abrasion resistance; bearing properties, good; used for bushings, bearings, washers, etc.

See advertisement, Page 6-D

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

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STERLING Stainless Steels—Firth-Sterling Steel Co., McKeesport, Pa.

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Type A (420); carbon .35, chromium 13.5; corrosion resistant; tensile strength 240,000 lbs. per sq. in.; for ball bearings and automotive parts subject to wear.

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Type T (410); carbon .1, chromium 13; possesses maximum strength and elasticity without sacrifice of toughness; machinable and corrosion resistant; for pump rods, shafts, valve parts, gun barrels, pistons and machinery parts where strength is of greater importance than ease of machining.

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Type TX (403); modified Type T used for turbine blading.

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Type FC (416); free cutting stainless steel wherein a slight sacrifice in physical properties and corrosion resistance is made to obtain easier machining; for machine parts including screws, bolts, nuts, pump shafts, valves and spindles.

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Nirosta, Types KA2, KA2-FC, KA2S and 19-9; of the 18-8 chrome-nickel group containing approximately 18 per cent chromium and 8 per cent nickel with various modifications or additions to give special physical properties, machinability or resistance to certain corrosive action; the free-cutting type can be easily machined, and cold work-hardened wire and strip have great strength and resiliency.

Type A (420); good physical properties in heat-treated state; maximum resistance to corrosion secured by hardening and through grinding; for wear resisting parts.

Type T (410); carbon .15, chromium 13; brinell hardness 165 untreated and 400 heat treated; high tensile strength; for valves, trim, pump rods, pistons, etc.

Type TX (403); developed for turbine blading.

Type M (430); soft ductile steel that does not work-harden readily; requires no heat treatment to secure corrosion resistance.

Type MG (442); used where strength and toughness are secondary to workability and high temperature resistance.

Type KA2 (302); an 18-8 steel; used particularly in oil and chemical industries; in hard wire this material is especially suitable for springs.

Type FC (303); free-machining 18-8 steel.

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STOODITE—Stoody Co., Whittier, Calif. A hard-facing metal used chiefly as overlay on earth working equipment.

1 2 3 - - - - - - -

STOODITE (Numbered)—Stoody Co., Whittier, Calif.; include Stoodite "45," "54" and "63," which range in physical properties from extreme hardness to extreme toughness. Rockwell "C" hardness indicated by numbers; designed for applications involving heat, corrosion, impact or abrasion.

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STOODY (Self-Hardening)—Stoody Co., Whittier, Calif. A hard-facing metal used chiefly as an overlay on earth working equipment.

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STRESSPROOF NO. 2—La Salle Steel Co., Hammond, Ind. A modified SAE X1340 steel furnished in finished bars for machining; tensile strength, ult., 100,000 lbs. per sq. in.; free machinability; good wearing qualities; used for worm gears, lead screws, spindles, shafts and speed reducers.

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SUMET—Sumet Corp., Buffalo.

SM-4; lead 28 per cent; for light and medium duty bearings in high-speed service.

SM-8; lead 26; for moderately severe service.

SM-10; lead 24; for bearings subject to shock and impact.

SM-12; lead 22; for slow speed under heavy load and impact.

SM-14; lead 14; for severe service subjected to heavy shock.

SM-16; lead 20; for heavy duty slow-speed service.

SM-18; lead 17½; for severe service; uses include roll neck bearings; also suitable for gear blanks.

SM-22; lead 10; for extremely severe heavy-duty service; abnormal loads.

1 - - 4 - - - - 8 -

SUMMERILL—Summerill Tubing Co., Bridgeport, Pa. Seamless tubing in practically all regularly used carbon grades from SAE 1010 to SAE 1.00. Others are chrome molybdenum SAE 4130X, 4140, 4150, 4185, 52,100, 4340; nickel silver, pure nickel silver, corrosion resistant steels—18-8, 16-13-3 and similar grades; 4 to 6 per cent chrome with ½ moly; also some of 12-14 per cent chrome. Used for aircraft, industrial control instruments, fuel injection tubing for diesel engines, etc.

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SUPERIOR STAINLESS—Superior Steel Corp., Carnegie, Pa.

1 2 3 - - - - - - -

Type 410; chromium 10-14, carbon .15 maximum.

Type 430; chromium 14-18, carbon .12 maximum.

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Type 301; chromium 16-18, nickel 7-9, carbon .09-.2.

Type 302; chromium 18-20, nickel 8-10, carbon over .08-.2.

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SUPERMAL—The Jeffrey Mfg. Co., Columbus, O. High strength malleable iron; resists heat to 400 degrees Fahr.; high abrasion resistance; tensile strength 70,000 lbs. per sq. in.; medium ductility; brinell hardness, heat treated, 180-200; used for cast chains for drives and conveyor service.

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SUPERTEMP—Bethlehem Steel Co., Bethlehem, Pa. A patented alloy steel having high tensile strength at high temperatures; suitable for bolts and studs for reaction chambers, cracking stills, superheaters, etc.

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SURFACEWELD—Lincoln Electric Co., Cleveland. A fine-grained alloyed powder for application with the carbon arc. Gives smooth abrasion resisting surface. Can be applied in thin layer. Properly applied, coating will have a hardness of 54 Rockwell C. Maintains hardness and resists scaling at high temperatures. Corrosion resistance comparable to stainless steel.

T

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TALIDE—Metal Carbides Corp., Youngstown, O. Tungsten carbide metal; resists corrosion due to high tungsten content; heat resistant to 2000 degrees Fahr.; high abrasion resistance; tensile strength 300,000 lbs. per sq. in.; specific gravity 14.1; brinell hardness, untreated, 130 and over; for use as wear plates and guides, cutting tools, drawing dies and bushings.

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TAMCO—Titanium Alloy Mfg. Co., Niagara Falls, N. Y. Alloys including original high and medium carbon ferro carbon-titanium, foundry ferro titanium, and several varieties of low carbon ferro titanium for rolled, cast and forged steels, stainless and alloy steels, and gray cast iron. For the nonferrous field, alloys include TAM Webbite (alumino-titanium) for aluminum castings, cupro-titanium for copper, nickel-titanium, molybdenum-titanium, and special alloys for special purposes, in addition to metallic titanium and metallic zirconium.

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TEMP ALLOY—Continental Roll & Steel Foundry Co., East Chicago, Ind. Chrome alloy heat resisting cast iron used for furnaces and other designs subject to high temperatures and abrasion.

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TEMPALOY—American Brass Co., Waterbury, Conn. Copper, aluminum and nickel alloys which yield to heat treatment; uses include motor boat shafting, piston rods, etc.

- - 3 4 - - - - 8 -

TETON—Allegheny-Ludlum Steel Corp., Pittsburgh. Carbon 1, chromium 1.4; for balls and ball races, bushings, cams, etc. Usually hardened in oil.

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THERMALLOY—Electro-Alloys Co., Elyria, O.

Grade A; 64-66 nickel, 17-20 chromium.

Grade 72; 58-62 nickel, 12-15 chromium.

Grade B; 38-42 nickel, 16-19 chromium; for rollers, chain, skid rails and disks.

Grade 50; 33-37 nickel, 14-16 chromium.

Grade C; under 2 nickel, 25-30 chromium; used in chemical industry for rabble arms, etc.

Grade D; 2-5 nickel, 25-30 chromium.

Grade E; 8-12 nickel, 24-28 chromium.

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THERMOMETAL—The H. A. Wilson Co., Newark, N. J. Thermostatic bimetals furnished in strips and formed parts for temperature control and temperature compensation.

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THOMASTRIP—Thomas Steel Co., Warren, O. Cold-rolled strip steel, bright finish uncoated and electro-coated in brass, bronze, nickel, nickel, zinc and tin.

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TI-COPPER NO. 39—Frontier Bronze Corp. A copper-chromium-titanium-silicon alloy furnished as castings; tensile strength, ult., 43,000-45,000 lbs. per sq. in.; compressive strength, ult., .001 at 23,000-25,000 lbs. per sq. in.; ductility, medium; nonmagnetic; brinell hardness, untreated 30-40, heat treated 100-120; for use in welding machines.

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TIGERLOY—Massillon Steel Casting Co., Massillon, O. Nickel-molybdenum; for shovel castings, gears, crane track wheels, castings for impact resistance, etc.

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TIMANG—Taylor-Wharton Iron & Steel Co., High Bridge, N. J. Nickel manganese steel; can be rolled, drawn, forged or shaped; for journal box liners, pedestal gib liners, conveyor flights, welding rod, etc.

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TIMKEN 17-22A—Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O. Carbon .3-.35, manganese .5 max., chromium 1-1.5, molybdenum .45-.65, vanadium .25-.35, furnished in rough bars or billets, and finished rods or bars, for hot forging, turning, boring, etc. Heat resistant to 1200 degrees Fahr.; tensile strength, ult., 200,000 lbs. per sq. in., min., heat treated; medium ductility; and brinell hardness, untreated 200, heat treated 470 max. Used for bolts, studs and other highly stressed parts at elevated temperatures.

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TIOGA—Allegheny Ludlum Steel Corp., Pittsburg. Carbon .67, manganese .6, chrome .65, nickel 1.4, molybdenum .2; combines good degree of hardness and toughness with fair nondeforming quality; oil hardening; used for lathe centers, clutch parts, rivets, cams, arbors, spindles, gears, shafts, etc.

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TISCO—Taylor-Wharton Iron & Steel Co., High Bridge, N. J.

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Stainless steel castings of all compositions, including chrome-molybdenum, nickel-chrome-molybdenum, 18-8 chrome-nickel, and high chromium.

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Manganese steel castings for shock and abrasion resistance. Used primarily for rock crushers, ball mill liners, sprockets, etc.

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TOBIN BRONZE—American Brass Co., Waterbury, Conn. Copper 60, zinc 39.25, tin .75; uses include piston rods, boat shafting, condenser head plates, welding rods, seamless tubes, etc.

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TOLEDO ALLOY—Unitcast Corp., Steel Casting Div., Toledo, O.

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No. 3; carburizing steel, heat treated to give good machinability and uniform grain; excellent results obtained with short cycle carburizing treatment.

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

No. 4; abrasion resistant silicon-molybdenum steel with good hardening properties; used for mining tools, wear plates, crusher plates and pinions.

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No. 6; air hardening die steel of uniform machining qualities; long life under severe wear.

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No. 7; triple heat-treated carbon vanadium steel for many applications in the railroad and locomotive industry where extensive and repeated stress is encountered.

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No. 8; pearlitic manganese steel with analysis adjusted to give high tensile strength and ductility; used in automotive and aircraft equipment and other machines. Adaptable to flame hardening for selective treatment and oil hardening for complete quenching treatment.

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TONCAN IRON—Republic Steel Corp., Cleveland. An open-hearth iron alloyed with .4 min. copper and .05 min. molybdenum; resists corrosion caused by atmosphere, water, oils and process materials; tensile strength, 50,000 lbs. per sq. in., min.; compressive strength 40,000; brinell hardness 110; for housing, piping, tubing, etc.

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TOOLWELD—Lincoln Electric Co., Cleveland. Coated arc welding electrode providing a deposit with hardness of 683-71 brinell; hardness retained to 1000 degrees Fahr.; deposit can be heat treated same as high-speed steel; for building hard, tough cutting edges on cold rolled steel and for other applications requiring super-hardness.

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TOPHET—Wilbur B. Driver Co., Newark, N. J.

Type A; approximately 80 per cent nickel and 20 chromium; resists heat to 2100 degrees Fahr.; supplied in wire and strip form for electrical heating applications.

Type C; nickel, chromium and iron; resists heat to 1900 degrees Fahr.; supplied in wire and strip form; for electrical resistance and heating applications; heat resistant.

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TRANTINYL—Youngstown Alloy Casting Corp., Youngstown, O. Furnished as sand castings. High abrasion resistance; medium ductility; high tensile strength; used for tools for tube and bar mills such as guide shoes, plugs, guides, etc.

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TRODALOY No. 1—General Electric Co., Schenectady, N. Y. Resistance welding electrode alloy containing 2.6 per cent cobalt, .4 beryllium, 97 copper; has 55 per cent conductivity of copper; 45,000 lbs. per sq. in. proportional limit; 220 brinell hardness; used for switch blades, cams, spring fingers, etc. Licensees are: Riverside Metal Co., P. R. Mallory Co., Ampco Metal Co., Electroloy Co., and Welding Sales & Engineering Co.

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TRUALOY—True Alloys Inc., Detroit.

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Copper; has high conductivity; castings for welding machines and conduction of current.

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Bearing bronze; low friction and wear, with high compressive strength; resistant to pounding and easy to machine.

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Aluminum; castings possessing strength, hardness and lightness.

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Aluminum bronze; for sand castings having corrosion resistance and tensile strength of 65,000 lbs. per sq. in.; recommended for parts subject to strain and wear.

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TUF-STUF—Mueller Brass Co., Port Huron, Mich. Copper 87, iron 3, aluminum 10; for application where high tensile strength, resistance to abrasion and to sulphuric acid are required.

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TUNG-ALLOY—Resisto-Loy Co., Grand Rapids, Mich. Tungsten 10, chromium 27, molybdenum 8, manganese .25, carbon 2, silicon .5; furnished in welding rods and electrodes; resists corrosion caused by acids and alkalis; resists heat to 1100 degrees Fahr.; abrasion resistance, high; tensile strength, ult., 120,000 lbs. per sq. in.; compressive strength, ult., 200,000 lbs. per sq. in.; weldability, good; brinell hardness, untreated, 627; for cutting edges for machine parts.

U

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UMA—Union Drawn Steel Div., Republic Steel Corp., Massillon, O. Free-machining steels; through the application of the Uma treatment abrasive inclusions which destroy tool life are eliminated. Available in following types: Freecut (SAE 1112), Supercut (SAE X-1112), Bessemer steels and SAE 1115, X-1315, X-1335, X-1015, 1015, 1035 and 1045 open hearth steels.

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UNILOY—Universal-Cyclops Steel Corp., Titusville, Pa.

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1435 (stainless grade A), (Type No. 420); chrome 13.5, nickel .5 max., carbon over .12.

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1860 (stainless grade B), (Type No. 440); chromium 17, nickel .5 max., carbon over .12.

18-8; (Type No. 302); chrome 18, nickel 8, carbon .2 max.; heat resisting to 1600 degrees Fahr.

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25-12, (Type No. 309); chrome 24, nickel 12; heat resisting to 1800 degrees Fahr.

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1409, (Type No. 410); stainless iron; chromium 13, carbon .12 max.

1809, (Type No. 430); high chrome stainless iron; chromium 18, carbon .12 max.

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2825, (Type No. 446); high chrome iron; chromium 28, carbon .35 max.; heat resisting to 2000 degrees Fahr.

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UNION—Union Drawn Steel Div., Republic Steel Corp., Massillon, O.

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Freecut; carbon .13 max., manganese .6-.9, phosphorus .08-.11, sulphur .1-.2; a free-cutting bessemer type steel.

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Supercut; bessemer type; manganese .6-.9, phosphorus .08-.11, and sulphur .2-.3; similar to Freecut.

Hymo; carbon .15-.2, manganese 1-1.3, phosphorus .04 max., and sulphur .1-.2; recommended for spark plug shells, hose brake couplings, piston pins, king pins and carburized gears.

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Special Carburizing; carbon .13-.18, manganese .6-.9, phosphorus .04 max., sulphur .05 max., silicon 15-30; recommended for piston pins and carburized gears.

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UNIVAN—Union Steel Casting Co., Pittsburgh. Nickel vanadium alloy; for locomotive frames, crossheads, coupling boxes, driving wheel centers, etc.

1 2 3 4 - - 7 - -

U. S. S.—United States Steel Corp., subsidiaries, including Carnegie-Illinois Steel Corp., Columbia Steel Co., National Tube Co., Tennessee Coal, Iron & Railroad Co., and American Steel & Wire Co.

1 2 - 4 - - - - - -

Type 302, U. S. S. 18-8; carbon .08-.2, chromium 18-20, nickel 8-10; resists heat to 1650 degrees Fahr., high abrasion resistance; atmospheric acid resistant; tensile strength, ult., 80,000-95,000 lbs. per sq. in. annealed, 185,000 lbs. per sq. in. cold worked; high ductility; weldability, good; brinell hardness, untreated, 135-185; for use as valve parts, nuts, bolts and shafting.

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Type 303, U. S. S. 18-8 F. M.; carbon .2, manganese 1.50, phosphorus .15, molybdenum .6 silicon .75, chromium 18-20, nickel 8-10; resists corrosion caused by industrial corrosives; resists heat to 1600 degrees Fahr.; high abrasion resistance; tensile strength, ult., 80,000-95,000 lbs. per sq. in.; high ductility; brinell hardness, untreated, 135-220; for nuts, bolts, valve parts, and shafting.

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Type 304, U. S S. 18-8-3; carbon .08 max., chromium 18-20, and nickel 8-10; similar to Type 302; used where corrosion resistance is desired after fabrication by welding.

1 2 - - - - - - - -

Type 309, U. S. S. 25-12; carbon .2, manganese 2, phosphorus .03, silicon .75, chromium 22-26, nickel 12-14. Corrosion and heat resistant; high abrasion resistance; tensile strength, ult., 90,000-110,000 lbs. per sq. in.; high ductility; brinell hardness, untreated, 160-190; for high temperature service.

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Type 316, U. S. S. 18-8 Mo.; carbon .1, manganese 2, phosphorus .03, silicon .75, chromium 16-18, nickel 14 max., molybdenum 2 to 3. Corrosion and heat resistant; high abrasion resistance, tensile strength, ult., 80,000-95,000 lbs., per sq. in.; high ductility for shafting, nuts, bolts, valves.

1 2 - 4 - - - - - -

Type 321, U. S. S. 18-8-Ti.; carbon .1 max., chromium 17-20, nickel 7-10, silicon .75, manganese 2, phosphorus .03, titanium four times actual carbon minimum; high temperature service and where welded parts are subject to corrosion.

1 2 - - 5 - - - - -

Type 347, U. S. S. 18-8 Cb.; carbon .1, chromium 17-18.5, nickel 8-12, manganese 2, phosphorus .03, silicon .75, columbium 10 times carbon min.; addition of columbium prevents susceptibility to intergranular corrosion; tensile strength, ult., 80,000-95,000 lbs. per sq. in.; high abrasion resistance; for high temperature service and where welded parts are subject to corrosion.

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Type 410, U.S.S. 12; carbon .15, manganese .75, phosphorus .03, sulphur .03, silicon .75, chromium 10-14, nickel .5; corrosion and oxidation resistant; responds to heat treatment and can be modified by addition of columbium, aluminum and molybdenum for specific applications; tensile strength, ult., 65,000 lbs. per sq. in. annealed, 125,000 lbs. per sq. in. heat treated; high ductility; high abrasion resistance; for turbine blading, shafting, valve parts, wire cable, screens, nuts and bolts.

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Type 416, U.S.S.-12 F.M.; carbon .15, manganese 1.25, phosphorus .04, sulphur or selenium .07 or molybdenum .6, silicon .75, chromium 12-14, nickel .5; similar to Type 410 except addition of sulphur, selenium or molybdenum increases the machinability; not to be used where welding is required; used for shafting, nuts, bolts, valve, trim and valve parts.

1 2 - - 5 - - - - -

Type 430, U.S.S.-17; carbon .12, manganese .75, phosphorus .03, sulphur .03, silicon .75, chromium 14-18, nickel .5; resists corrosion caused by nitric acid, atmosphere and industrial corrosives; resists heat to 1550 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 75,000-85,000 lbs. per sq. in., high ductility; used in nitric acid equipment, as screens, valves, shafting, nuts, bolts and rivets.

1 2 - - - - - - - -

Type 446, U.S.S.-27; carbon .35, manganese 1, phosphorus .035, sulphur .035, silicon 1.5, chromium 23-30, nickel 1; resists heat to 2100 degrees Fahr.; medium abrasion resistance; tensile strength, ult., 75,000-95,000 lbs. per sq. in.; medium ductility; for high temperature service, where resistance to sulphides and concentrated nitric acid is required.

Type 501, U.S.S.-5; carbon over .1 and chromium 4-6.

Type 502, U.S.S.-5-S; carbon .1 max., chromium 4-6; molybdenum .5 is added to increase creep strength and avoid temper brittleness; columbium is added to eliminate air hardening and increase oxidation resistance slightly.

1 2 - - - - - - - -

Shelby 5 per cent chrome molybdenum tubing; used for furnace tubes in oil cracking stills, condensers and superheaters where high temperatures and pressures, and corrosive fluids are handled; chromium .15

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

max., manganese .5 max., silicon .5 max., carbon 4-6, and molybdenum .45-.65.

Shelby tubing may be obtained in many additional grades from the lowest carbon boiler tube steel to the stainless grades of alloy steel which are available in tubing in all sizes up to 10¾ inches outside diameter. A number of steels made to S.A.E. standards are also furnished in Shelby tubing.

Castings furnished by Lorain Div.: Type A-1; carbon .3-.4, chromium .75-1, nickel 2.5-3, manganese .6-.8, and molybdenum .3-.4; Type A3; carbon .45-.55, chromium .75-.9, nickel .6-.8, manganese 1.5-2, and molybdenum .3-.4; and Type MS-1; carbon 1-14, chromium .75-1, manganese 10-14.

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Electrical steel sheets for use in transformers, motors and generators; Ten principal grades of electrical sheets furnished—U.S.S. Pole, Field, Armature, Electrical, Motor, Dynamo, Radio Transformer 72, and Transformer 72, 65 and 58.

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Other materials are furnished as follows: Carnegie-Illinois Steel Corp., stainless steel in sheets, plates, shapes and bars; National Tube Co., in pipe and tubular shape; and American Steel & Wire Co., in strip and wire forms.

See advertisements, Pages 5-D, 53-D

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U. S. S. AR STEEL (Abrasion Resisting Steel)—Carnegie-Illinois Steel Corp., Pittsburgh. Carbon .35-.5, manganese 1.5-2, phosphorus .05 max., sulphur .055 max., silicon .15-.3, copper .2 min.; furnished in rough bars or billets, finished rods or bars, sheets, strips, plates, and shapes, for welding. Corrosion resistant if copper included; high abrasion resistance; tensile strength, ult., 100,000-125,000 lbs. per sq. in.; medium ductility; specific gravity, 7.8-7.9; brinell hardness, untreated 250, heat treated 450-475; bearing properties, good. Used for wearing surfaces.

See advertisements, Pages 5-D, 53-D

U.S.S. CARILLOY—Carnegie-Illinois Steel Corp., Pittsburgh. Alloy steels in all standard grades of S.A.E. steels sold under the above tradename.

See advertisements, Pages 5-D, 53-D

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U. S. S. COR-TEN—Carnegie-Illinois Steel Corp., Pittsburgh. Carbon .12 max., manganese .5 max., phosphorus .06-.15, sulphur .05 max., silicon .25-.75, copper .3-.5, chromium .5-1; furnished in rough bars or billets, finished rods or bars, tubing, wire, sheets, strips, plates, structural and bar shapes, for hot forging, stamping, welding, riveting, turning, boring, etc. Resists corrosion caused by atmosphere, sea and fresh water; resists heat to 1525 degrees Fahr.; abrasion resistance, high; tensile strength, ult., 70,000 lbs. per sq. in.; ductility, high; specific gravity, 7.8-7.9; bearing properties, good; weldability, good; brinell hardness, untreated, 165-190. Used for lightweight construction.

See advertisements, Pages 5-D, 53-D

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U.S.S. MAN-TEN—Carnegie-Illinois Steel Corp., Pittsburgh. Carbon .3 max., manganese 1.25-1.7, phosphorus .04 max., silicon .3 max., sulphur .05 max., copper .2 min.; furnished in rough bars or billets, finished rods or bars, tubing, sheets, strips, plates, structural and bar shapes, for hot forging, welding and riveting; corrosion resistant; high abrasion resistance; tensile strength, ult., 80,000 lbs. per sq. in.; high ductility; specific gravity, 7.8-7.9; good bearing properties and weldability; brinell hardness, untreated 175, heat treated 340; used for frames and light machine parts.

W

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WAUKESHA—Waukesha Foundry Co., Waukesha, Wis. Copper base alloy with high nickel content; resists acids in food products; recommended for sand cast parts for food handling and dairy machinery. White in color, easy to machine, polishes well.

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WEARTUF—Horace T. Potts Co., Philadelphia. Carbon-manganese-silicon abrasion resisting alloy steel, furnished in sheets and plates, for hot forging, welding, forming, turning, boring, etc. Abrasion resistance, medium; ductility, low; good weldability; brinell hardness, untreated 265. Used for wear and abrasion resistant applications such as hoppers, chutes, conveyors, etc.

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WEARWELD—Lincoln Electric Co., Cleveland; brinell hardness 488-548; suitable for hardfacing wearing surfaces subject to shocks and abrasion.

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WELLCAST 17 S—The Wellman Bronze & Aluminum Co., Cleveland. High-strength, aluminum-silicon-titanium alloy with high ductility; used in aircraft castings; tensile strength, 28,000-30,000 lbs. per sq. in.

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WILLIAMS No. 50 BRONZE—E. A. Williams & Son, Jersey City, N. J. Furnished in grades A, B, C and D, as sand castings; resists corrosion caused by almost all acids except nitric, hydrofluoric sulphurous; abrasion resistance, high; tensile strength, ult., 130,500-160,000 lbs. per sq. in.; medium ductility; bearing properties, good; brinell hardness, 149-300; for use as bushings, gears, worm wheels, acid equipment dies.

1 2 - - - - - - - -

WILRICH—Wilcox-Rich Div., Eaton Mfg. Co., Detroit. Boron, cobalt, chrome and nickel alloys ranging from 250-700 brinell; centrifugally cast, forming bi-metal or lined steel bushings.

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WILSON CONTACT MATERIALS, Electrical—The H. A. Wilson Co., Newark, N. J. Silver, platinum, tungsten and alloy contacts; silver-steel laminated contacts for projection welding; silver composite contacts; silver and platinum inlay and overlay on base metals. Furnished in sheet and wire.

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WOLVERINE—Wolverine Tube Co., Detroit.

Aluminum brass; copper 76, zinc 22, aluminum 2; furnished in tubing; resists corrosion caused by salt water and marine land stations; medium abrasion resistance; tensile strength 52,000-90,000 lbs. per sq. in.; medium ductility; good bearing properties; for bushings, condenser tubing.

Admiralty brass; copper 70, zinc 29, tin 1; furnished in tubing; medium abrasion resistance; tensile strength 50,000-95,000 lbs. per sq. in.; medium ductility; specific gravity 8.51; weldability fair; for condenser tubing.

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70-30 brass; copper 70, zinc 30; furnished in tubing; resists corrosion; medium abrasion resistance; tensile strength 45,000-70,000 lbs. per sq. in.; medium ductility; specific gravity 8.53; weldability fair; used for condenser tubing.

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Red brass; copper 85, zinc 15; furnished in tubing; resists corrosion caused by salt water, mild acids and water supply; medium abrasion resistance; tensile strength 42,000-75,000 lbs. per sq. in.; ductility high; specific gravity 8.93; good weldability; for condenser tubing.

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Common high brass; copper 66, lead .8 max., zinc balance; furnished in tubing; resists corrosion caused by water supply; medium abrasion resistance; tensile strength 45,000-90,000 lbs. per sq. in.; medium ductility; specific gravity 8.47; weldability fair; bearing properties fair; for cupped, formed or drawn parts, etc.

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Copper, oxygen-free; copper and silver 99.9 min., phosphorus .015-.035 (optional as deoxidizer); furnished in tubing; resists corrosion caused by atmospheric and acid solutions of low oxidizing capacity and hot reducing gases; tensile strength 32,000-60,000 lbs. per sq. in.; high ductility; specific gravity 8.93; good weldability; for condensers, evaporators, heaters and condenser tubes, sugar mills, refrigeration, etc.

Copper-Arsenical; copper and silver 99.2 min., phosphorus .015-.035, and arsenic .15-.75; furnished in tubing; resists corrosion caused by atmospheric and acid solutions of low oxidizing capacity and hot reducing gases; tensile strength 32,000-60,000 lbs. per sq. in.; ductility high; specific gravity 8.93; weldability good; for condensers, evaporators, heater and condenser tubes, sugar mills, refrigeration, etc.

X

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X-7—General Alloys Co., Boston. Chrome 23-28, nickel 10-13; tensile strength 80,000 lbs. per sq. in.; recommended for castings subject to temperatures to 2000 degrees Fahr.

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XALOY—Wilcox-Rich Div., Eaton Mfg Co., Detroit. Boron iron from 700-750 brinell hardness; centrifugally cast forming bi-metal or lined steel bushings.

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X-ITE—General Alloys Co., Boston. Nickel 37-40, chromium 17-21; for furnace parts not subjected to alternate heating and cooling cycles; standard material for commercial heat treating furnace parts.

Y

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YOLOY—Youngstown Sheet & Tube Co., Youngstown, O. Special service alloy steel of increased tensile strength and high ductility combined with corrosion resistance, machinability and weldability.

Z

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ZAMAK—New Jersey Zinc Co., New York. Zinc alloys for die cast machine parts.

No. 2; aluminum 4.1, copper 2.7, magnesium .03, remainder Horse Head special zinc.

No. 3; aluminum 4.1, magnesium .04, remainder Horse Head special zinc.

No. 5; aluminum 4.1, copper 1, magnesium .03, remainder Horse Head special zinc.

See advertisement, Page 61-D

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ZILLOY—New Jersey Zinc Co., New York, Copper .85-1.25, magnesium .006-.016, balance zinc; furnished in sheets and strips for stamping; resists corrosion caused by moisture; resists heat to 250 degrees Fahr.; medium abrasion resistance; tensile strength, 20,000-45,000 lbs. per sq. in.; compressive strength, 40,000-80,000; medium ductility; used for nameplates, small cover plates and caps, escutcheons, and molding trim.

See advertisement, Page 64-D

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ZINCGRIP—American Rolling Mill Co., Middletown, O. Galvanized sheet iron or steel, in strips or coils, with unusual forming and drawing qualities; for use wherever severe forming makes ordinary galvanized sheet metal unsatisfactory.

1—Corrosion resistant; 2—Heat resistant; 3—Abrasion resistant; 4—High tensile strength; 5—High ductility; 6—Bearing application; 7—Electrical uses; 8—Heat treating; 9—Low specific gravity

Plastics and other Nonmetallics Listed by Tradenames

(For listing by producing companies, and complete street addresses, see Page 42-D)

A

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ACE—American Hard Rubber Co., New York. Hard rubber; furnished in sheets, rods or tubes; may be machined, molded or stamped into part; corrosion resistance; low moisture absorption; high polish; tensile strength 4000-9000 lbs. per sq. in.; heat resistance 150-190 degrees Fahr.; dielectric strength 250-290 volts per mil.; nonflammable. Uses include handles, caster wheels and special molded parts.

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AERTITE—Johns-Manville, New York. Rubbery, asphaltic-asbestos base; furnished in soft plastic form; corrosion resistant, heat resistant; nonflammable. Used on mechanical equipment to prevent air infiltration.

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AETNA—Aetna Rubber Co., Cleveland. Hard rubber; furnished in rods and sheets; corrosion resistant; comparatively high tensile and dielectric strengths; unusually low specific gravity. Used for storage battery containers, vent caps, covers and nuts.

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AIRVULC—Self-Vulcanizing Rubber Co. Inc., Chicago. Gum rubber base; furnished in liquid; abrasion and corrosion resistant; tensile strength, 2000 lbs. per sq. in.; shock resistant; high polish; flexible; heat resistance, 212 degrees Fahr.; low moisture absorption; available in colors. Used as a sound deadener and for insulation and waterproofing.

- - - - - 6 7 - 9 -

AMEROID—American Plastics Corp., New York. Casein base, thermoplastic; furnished in sheet or rod form, for machining; nonflammable; high polish; available in colors; corrosion resistant; tensile strength, 7600 lbs. per sq. in.; heat resistance, 150 degrees Fahr.; translucent; dielectric strength 290 volts per mil. Used for small knobs, bushings, washers and similar parts.

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AMPHENOL—American Phenolic Corp., Chicago.

Type 912-B Ribbon; polystyrene base; thermoplastic; furnished in ribbon or thin sheeting from .0005-.015 in. thickness; .001 in. thickness can be highly polished; noncorrosive; flexible; available in colors; nonflammable; translucent; high tensile strength. Used as thin wall for electrical insulation.

Type 912; polystyrene base; thermoplastic; furnished in sheets, rods and tubes for laminating, molding, machining or stamping into parts; high dielectric strength; low moisture absorption; available in colors; translucent; nonflammable; high polish; corrosion resistance. Uses include electrical sockets, plugs, insulators and acid resistant tubing.

1 2 - - - - - - - - 10

ASBESTOPRENE—Victor Mfg. & Gasket Co., Chicago. Mineral-base asbestos; furnished in sheet and laminated form for stamping into parts; abrasion, corrosion and heat resistant; flexible; high tensile strength; low moisture absorption; nonflammable; shatterproof; used for gaskets.

B

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BAKELITE—Bakelite Corp., New York.

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Cellulose filled, phenolic base; thermosetting; furnished in powder form for molding into part; corrosion resistant, dielectric strength 300-500 volts per mil; nonflammable; tensile strength 6000-11,000 lbs. per sq. in.; low thermal conductivity; available in colors; low moisture absorption. Used for knobs, handles and electric insulating parts.

- 2 - - 5 - - - - 10

Mineral filled; similar to above but has higher heat resistance and lower moisture absorption.

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Fabric filled; similar to cellulose Bakelite but contains chopped fabric; high impact resistance; abrasion resistance; dielectric strength, 300-400 volts per mil. Used for gears, bushings, bearings and lever handles.

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Laminated; furnished in sheets, tubes and rods for machining; resistant to shock; high dielectric strength; low oil absorption; translucent in some forms; tensile strength 8500-24,000 lbs. per sq. in.; flexible in sheet forms. Used for gears, bushings, etc.

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Cast resinoid C-1 and C-25; furnished in sheets, tubes, rods and special forms for casting and machining; translucent; high polish; available in colors; other properties similar to mineral and cellulose-filled. Used for decorative fittings, transparent gages, instruments or parts requiring resistance to hydrofluoric acid.

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Polysterene; styrene base thermoplastic; furnished as powder for molding into parts; tensile strength 5000-5500 lbs. per sq. in.; impact strength .14-.16 ft. lbs.; high dielectric strength; low water absorption; resistant to chemicals; specific gravity 1.05-1.07; available in water-white.

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BEETLE—Beetleware Division, American Cyanamid Co., New York. Urea formaldehyde base, thermosetting; furnished in powder and liquid for laminating or molding; available in colors; resistant to shock; translucent; high polish; dielectric strength 380 volts per mil; tensile strength 7000 lbs. per sq. in.; nonflammable. Used for housings, cabinets, knobs, dials, panels and insulators. Material is available with slightly different properties for specific applications.

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BOOTH FELT—Booth Felt Co. Inc., Brooklyn, N. Y. Wool base felt; furnished in sheets or strips for machining or stamping into parts; heat resistance 400 degrees Fahr.; tensile strength, 5-100 lbs. per sq. in.; available in colors and in a variety of types and grades; used for washers, gaskets, grease seals, and pads for insulating machinery or reducing vibration.

See advertisement, Page 57-D

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BRANDYWINE FIBRE—Brandywine Fibre Products Co., Wilmington, Del. Paper chemically treated to form a solid homogeneous mass; furnished in tubes; dielectric strength 250 volts per mil; tensile strength 5000-8500 lbs. per sq. in.; heat resistance 150-200 degrees Fahr.; available in colors; impact resistant; specific gravity 1.20-1.45. Used for spacers, ferrules, washers, handles, bearings and noiseless bumpers.

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CASKOFELT—Western Felt Works, Chicago. Felt material saturated with synthetic rubber; used for packing and gasketing.

See advertisement, Page 59-D

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CATALIN—Catalin Corp., New York. Phenolic base, thermosetting; furnished in sheets, rods, or special castings; high dielectric strength; nonflammable; low moisture absorption; high tensile and compressive strengths; available in colors; insoluble in ordinary solvents. Used for clock and instrument cases, auto fittings, knobs for electrical appliances, etc.

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CELITE—Johns-Manville, New York. Diatomaceous silica material; furnished in powdered, granular and brick forms; resistant to chemical corrosion; heat resistant; nonflammable. Used for insulation of equipment operating at high temperatures.

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CELLANITE—Continental-Diamond Fibre Co., Newark, Del. Resinous base, thermosetting material; furnished in laminated form, for machining into parts; corrosion resistant; heat resistant; low moisture absorption; high dielectric strength; high tensile strength; thermal insulation; odor repellant. Used for frost breaker strips on refrigerator cabinets and many other applications.

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CELLULOID—Celluloid Corp., Newark, N. J. Cellulose nitrate base, thermoplastic; furnished in sheets, rods and tubes, for molding, swedging, veneering, machining or stamping into parts; available in colors; high polish; tensile strength 5000-10,000 lbs. per sq. in.; flexible; resistant to corrosion; dielectric strength 600-1200 volts per mil; transparent. Used for instrument dials, tool handles, key buttons, register wheels, etc.

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CEL-O-GLASS—E. I. du Pont de Nemours & Co., Wilmington, Del. Plastic-coated wire mesh which transmits ultra-violet rays; corrosion resistant; resistant to shock; translucent; flexible; light weight. Used for sign boards, display backgrounds or any place where an opalescent or translucent flexible material is required.

See advertisement, Page 9-D

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CELORON — Continental-Diamond Fibre Co., Newark, Del. Resinous base, thermosetting; furnished in molded laminated form, for machining into parts; corrosion resistant; resistant to shock; high tensile strength; low moisture absorption; high heat resistance and abrasion resistance. Grade C (canvas base) used for heavy-duty gears. Type L (linen base) used for small gears of fine pitch and narrow face.

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CODITE—Continental-Diamond Fibre Co., Newark, Del. Vulcanized fibre, thermoplastic; furnished in molded sheets, rods and tubes, for machining into parts; high tensile and dielectric strength; translucent; flexible; high polish. Used for washers and parts requiring a hard, tough, flexible material.

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COLASTA No. 56—Colasta Co. Inc., Div. of Specialty Insulation Mfg. Co. Inc., Hoosick

1—Corrosion resistance; 2—High heat resistance; 3—Impact resistance; 4—High tensile strength; 5—High dielectric strength; 6—Nonflammable; 7—Takes high polish; 8—Translucence; 9—Available in colors; 10—Low moisture absorption

Falls, N. Y. Resinous material compounded with small percentage of rubber; corrosion resistant; high dielectric strength; low moisture absorption. Used for aircraft magneto applications; highly resistant to carbon tracking; impervious to oil and weak acids.

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CORPRENE—Armstrong Cork Products Co., Lancaster, Pa. Cork and synthetic rubber compound; cold molded into parts; corrosion resistant; comparatively high heat resistance; low moisture absorption; surface giving high coefficient of friction; extreme resistance to oil, oxidation, corona and weather. Used for sealing on gaskets, valve disks and valve packings, etc.

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CRYSTALITE—Rohm & Haas Co. Inc., Philadelphia. Acrylic base, thermoplastic; furnished in molding powder for compression and injection molding; corrosion resistant; resistant to shock; transparent; flexible; specific gravity 1.18; tensile strength 4000-6000 lbs. per sq. in.; available in colors and high polish. Used for unbreakable gage dial covers and moldings of all kinds.

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DIAMOND — Continental-Diamond Fibre Co., Newark, Del. Vulcanized fibre, bone-like material; furnished in sheets, rods and tubes, for machining, sawing or punching into parts; high tensile and dielectric strengths; low specific gravity; tough; pliable. Used for insulating members, gears, bobbin heads, etc.

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DILECTO — Continental-Diamond Fibre Co., Newark, Del. Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes, for machining or stamping into parts; dielectric strength 270-500 volts per mil; low moisture absorption; tensile strength 10,000-25,000 lbs. per sq. in.; corrosion resistant; heat resistance 290 degrees Fahr., available in colors; resistant to shock; insoluble. Used for electrical, thermal and mechanical insulating parts.

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DUFELT—Felters Co. Inc., Boston, Mass. Laminated felt; corrosion resistant; high dielectric strength; low moisture absorption. Uses include washers for oil and grease retainment; shapes for resiliency, sound isolation, vibration absorption, heat insulation; covers for polishing rolls; wicks for lubrication; dustproofing, filtering.

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DUREZ—Durez Plastics & Chemicals Inc., North Tonawanda, N. Y. Phenolic base, thermosetting; powder form, for molding into parts; resistant to corrosion; high polish; low moisture absorption; heat resistance 350-550 degrees Fahr.; tensile strength 4000-7000 lbs. per sq. in.; available in colors; shock and abrasion resistant. Used for housings, handles, bases, electrical parts, small gears, frames, hoods, etc.

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DURITE—Durite Plastics Inc., Frankford Sta., P. O., Philadelphia. Phenol-furfural and phenol-formaldehyde synthetic resins, heat-setting; available in crushed, pulverized or liquid form, for bonding hot or cold molding compound, plywood, veneer, cements, abrasive articles, etc.; or in powder form for hot press molding; possesses high heat and shock resistance; high tensile and dielectric strengths. Used for cabinets, housings, handles, keys, knobs, automotive ignition, etc

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EBROK—The Richardson Co., Melrose Park, Ill. Acid-resisting bituminous plastic for specific requirements including such parts as battery containers.

See advertisement, Page 59-D

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EEL-SLIP—Johns-Manville, New York. Asbestos fiber, graphite and rubber compound; heat resistant; high tensile strength; nonflammable. Used for bearings, suction box covers, etc.

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EMPIRE—Mica Insulator Co., New York. Varnished cambric cloth; high tensile strengths; pliable; resistant to aging. Used for electrical insulation of cables, bus bars, coils, joints, splice work, etc.

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ETHOCEL—The Dow Chemical Co., Midland, Mich. Plastic granules, thermoplastic; furnished in granular form for molding; dielectric strength 1500 volts per mil on .10-in. thickness; tensile strength 7000-8500 lbs. per sq. in.; heat resistance 130-150 degrees Fahr.; low moisture absorption, good dimensional stability, available in color; specific gravity 1.10-1.25, translucent; opaque; compressive strength 10,000-12,000 lbs. per sq. in. Used for knobs and insulation.

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ETHOFOIL—The Dow Chemical Co., Midland, Mich. Ethyl cellulose base thermoplastic, transparent or opaque; furnished in sheet form, can be laminated, heat-formed or cemented; corrosion resistant; flexible; dielectric strength 3500 volts per mil on .001-inch thickness; tensile strength 10,000 lbs. per sq. in.; heat resistance 250 degrees Fahr.; low moisture absorption; available in colors; specific gravity 1.14. Used for insulating foil.

See advertisement, Page 7-D

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FARLITE—Farley & Loetscher Mfg. Co., Dubuque, Iowa. Phenolic and urea base, thermosetting; furnished in laminated sheets; for machining and stamping into parts; resistant to corrosion; high polish; low moisture absorption; impact resistant; translucent; available in colors; tensile strength 6000-8000 lbs. per sq. in.; dielectric strength 200-400 volts per mil. Used for sawed or stamped flat parts for light machine members.

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FARLITE LOETEX—Farley & Loetscher Mfg. Co., Dubuque, Iowa. Fibrous synthetic core with laminated Bakelite surface, thermosetting; furnished in sheets, for machining into parts; dielectric strength 250 volts per mil; resistant to corrosion; high polish; resistant to impact; low moisture absorption; tensile strength 5000-6000 lbs. per sq. in.; heat resistant 250 degrees Fahr. Used for low voltage insulation with moderate strength.

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FELTERS CERTIFIED FELT—Felters Co. Inc., Boston. Felt cut to size for grease and oil retention; for lubricators, bumpers, antisqueak and rattle parts, filters.

FIBERGLAS—See under tradename O-I FIBERGLAS

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FORMICA—Formica Insulation Co., Cincinnati. Resinous base, thermosetting; furnished in laminated form, for machining or stamping into parts; corrosion resistant; tensile strength is slightly less than cast iron; high dielectric strength; absorbs no oil; changes in dimensions only slightly as the result of moisture absorption. Used for insulating washers and bushings, punched parts in switches, automotive starting systems and all types of heavy-duty gears.

See advertisement, Page 10-D

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FYBEROID — Wilmington Fibre Specialty Co., Wilmington, Del. Paper base; furnished in sheet form, for machining or stamping into parts; dielectric strength 200-400 volts per mil; tensile strength 5000-8000 lbs. per sq. in.; flexible; abrasion and corrosion resistant. Used for insulation on motors, generators, automotive ignition starters, etc.

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GEMLOID (Enamcloid Cloisonnete)—Gemloid Corp., Elmhurst, L. I., N. Y. Cellulose, acetate and nitrate base, thermoplastic; in laminated sheet form, for molding or stamping into parts; high polish; flexible; nonflammable; available in colors; translucent. Used for decorative dials for radios, clocks, instrument panels and horn buttons.

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GUMMON—Garfield Mfg. Co., Garfield, N. J. Black, thermosetting; corrosion and heat resistant (400 degrees Fahr.); high dielectric strength; high polish; resistant to hot oil. Will not shrink, crack, warp or deteriorate with age. Used for insulated parts such as wiring devices and other small units.

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HARVITE—Siemon Co., Bridgeport, Conn. Shellac base, thermosetting; molded into parts; corrosion resistant; low moisture absorption; available in colors; heat resistance 175 degrees Fahr.; high dielectric strength. Used for insulated switch handles and as electric insulator.

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HASKELITE—Haskelite Mfg. Corp., Chicago. Waterproof plywood; light weight; high strength; elastic; hard; bendable into desired forms and shapes. Used for airplanes, buses, street cars, railways, radio cabinets and speakers, passenger cars, etc.

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HAVEG—Haveg Corp., Newark, Del. Phenolic base, thermosetting; furnished in finished form, molded or machined into parts; corrosion resistant; heat resistance 275 degrees Fahr.; resistant to shock and abrasion; tensile strength 5600 lbs. per sq. in.; low moisture absorption; nonflammable. Used for parts where chemical resistance is an important factor.

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HAVEGIT—Haveg Corp., Newark, Del. Phenol formaldehyde base, thermosetting cement; corrosion resistant (acids); heat resistant; low moisture absorption; properties similar to Haveg. Used in setting up brick and tile linings in chemical equipment.

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HEMIT — Garfield Mfg. Co., Garfield, N. Y. Gray-white material; corrosion resistant; heat resistance 1100-1500 degrees Fahr.; low moisture absorption. Used for interior parts of heating devices, such as arc shields or where a molded part must withstand an arc.

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HERESITE—Heresite & Chemical Co., Manitowoc, Wis. Phenolic resin, thermosetting; furnished in rods or tubes, powder or in laminated form, for molding, casting, and machining; corrosion, heat and impact resistant; high tensile and dielectric strengths; nonflammable; available in colors; translucent; low moisture absorption. Used for rayon machine parts and electrical equipment.

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HY-TEMP—Keasbey & Mattison Co., Ambler, Pa. Magnesia and asbestos base; combination heat insulating blocks and cements, furnished in powder or laminated form; good corrosion resistance; rigidity; high heat resistance, low moisture absorption, nonflammable, and low thermal conductivity. Used for thermal insulation for furnaces.

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INCELOID — Inceloid Co. Inc., New Orleans. Cellulose derivative, thermoplastic; furnished in sheet and laminated form for casting into parts; corrosion and heat resistant; can be highly polished; flexible; high dielectric strength; low moisture absorption, available in colors; shatterproof. Used for electrical insulation, laminating work, etc.

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INDUR—Reilly Tar & Chemical Corp., Indianapolis. Phenolic base, thermosetting; furnished in powder form, for molding into parts; tensile strength 7200 lbs. per sq. in.; high dielectric strength; nonflammable; corrosion resistant; available in colors; specific gravity 1.2-1.9. Used for instruments and machine accessories including insulating panels, knobs and handles.

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INDUR VARNISH—Reilly Tar & Chemical Corp., Indianapolis. Phenolic base, thermosetting; furnished in liquid form, for molding into parts; high dielectric and tensile strengths; nonflammable.

1—Corrosion resistance; 2—High heat resistance; 3—Impact resistance; 4—High tensile strength; 5—High dielectric strength; 6—Nonflammable; 7—Takes high polish; 8—Translucence; 9—Available in colors; 10—Low moisture absorption

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INSULKOTE — Johns-Manville, New York. Weatherproof coating for use over insulation of ducts and other exposed equipment; corrosion resistant; heat resistant; low moisture absorption.

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INSUROK—The Richardson Co., Melrose Park, Ill.

Thermosetting type; furnished in laminated sheets, rods and tubes for machining into parts, or as finished molded parts; corrosion resistant; low moisture absorption; high tensile strength; resistant to shock; comparatively low specific gravity. Used for gears, bearings, electrical insulation. Available in different grades.

Translucent type; urea or phenolic base, thermosetting; furnished in molded and laminated sheets for signs, displays, rear illumination and changeable background signs. Material is translucent, does not support combustion, and has low moisture absorption.

See advertisement, Page 59-D

K

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KEASBEY ASBESTOS—Keasbey & Mattison Co., Ambler, Pa. Base varies depending upon use of material. Furnished in sheet, rods, tubes, powder, or in laminated form to be molded, machined or stamped. Principal properties depend upon use, having good corrosion resistance, high heat resistance and nonflammability. Used for thermal insulation.

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"K" FELT—American Felt Co., New York. Kapok fiber 45, cotton 30 and wool 25; furnished in rolls approximately 24 yards long and 72 inches wide, in thicknesses from ⅛ inch to 1 inches in ⅛ inch increments, in white or silver gray; flameproof; mothproof; low moisture absorption. Used for insulating material and numerous other purposes. Also available in S.A.E. felt specifications.

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KNIGHT-WARE—Maurice A. Knight, Akron, O. Acid-proof chemical stoneware obtainable in a wide variety of special shapes and sizes; inert to corrosion of all chemical solutions or gases except hydrofluoric acid and caustic soda; very hard; excellent dielectric strength; resistant to heat but not sudden heat changes. Used for valves, pipes, jars, tanks, filters, towers, etc.

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KOMPO-KORK—Korfund Co. Inc., Long Island City, N. Y. Plates of finely granulated compressed cork with an oxidized linseed oil binder and burlap backing; corrosion and shock resistant; low moisture absorption. Used where irregularly shaped plates are required for isolating light machinery to combat vibration.

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KORFUND—Korfund Co. Inc., Long Island City, N. Y. Resilient mat of pure natural cork, steel bound and oil treated; corrosion and shock resistant; unaffected by acids and temperature changes; low moisture absorption. Used as machine bases to reduce vibration. Another isolator developed by the company is identical in construction, but is bound with asphalt and felt.

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KORK-RUBBER—Korfund Co. Inc., Long Island City, N. Y.—Plates of finely granulated cork and rubber particles compressed together; corrosion and shock resistant; low moisture absorption. Used for vibration dampening of light machines.

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KOROSEAL—B. F. Goodrich Co., Akron, O. Synthetic elastic; furnished in various consistencies from jelly to bone-like hardness; corrosion and shock resistant; available in colors. Jelly is used for making molds for plastic casts, but other compounds sold only as finished products. Superior to rubber in flexing, oxidation and penetration of moisture or gases; does not swell in oil. Available in molded and extruded forms; also applied as coating to paper and fabric.

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LAMICOID—Mica Insulator Co., New York.

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Paper filled, phenolic base, thermosetting; furnished in sheet and laminated forms or rods and tubes, for machining and stamping into parts; tensile strength 7000-8000 lbs. per sq. in.; heat resistance 250 degrees Fahr.; moisture absorption 1-6 per cent; dielectric strength 500 volts per mil; high polish; nonflammable; available in colors. Used for panel boards, gears, thrust washers, valves, bushings, barriers and punchings.

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Fabric filled—Similar material to above but has higher tensile strength—9000-10,000 lbs. per sq. in. and lower moisture absorption—1½-2½ per cent.

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Micoid—Similar to above materials but is available in black and brown colors; tensile strength and dielectric strength slightly lower than above.

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LAMITEX—Franklin Fibre-Lamitex Corp., Wilmington, Del. Phenolic base, thermosetting; furnished in laminated sheets, rods or tubes, for machining and stamping into parts; corrosion resistant; high polish; dielectric strength 500 volts per mil; tensile strength 15,000 lbs. per sq. in.; heat resistance 300 degrees Fahr.; low moisture absorption; nonflammable; compressive strength 35,000 lbs. per sq. in. Used for electrical insulation.

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LUCITE—E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Polymethyl-methacrylate base, thermoplastic; furnished in powder or sheets, rods and tubes, for molding, casting and machining into parts; translucent; high dielectric strength; available in colors; resistant to shock; low moisture absorption; high polish; resistant to corrosion; tensile strength 8000-10,000 lbs. per sq. in.; heat resistance 170-220 degrees Fahr. Used for panels, knobs, models, safety guards, dials and gage glasses.

See advertisement, Page 9-D

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LUMARITH—Celluloid Corp., Newark, N. J. Cellulose acetate base, thermoplastic; furnished in sheets, powder or rods and tubes; Also parts molded to customers' specifications on experimental basis. Available in colors; tensile strength 15,000 lbs. per sq. in.; dielectric strength 500-2500 volts per mil; high polish; flexible; resistant to shock and corrosion. Used for instrument dials and housings, radio grills, panels, airplane windshields, handles, knobs, register wheels, key buttons, electrical insulated parts, steering wheels, instrument panel knobs, etc.

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LUMARITH PROTECTOID — Celluloid Corp., Newark, N. J. Cellulose acetate base, thermoplastic; furnished in sheet, and rolls or reels in thicknesses of .0007-.0001, for laminating, swedging, drawing, or stamping into parts; abrasion and corrosion resistant; flexible; dielectric strength 2000-25,000 volts per mil; tensile strength 5000-11,000 lbs. per sq. in.; heat resistant to 275 degrees Fahr.; nonflammable; transparent. Used for laminated slot insulation paper for motors, wire insulation, formed insulators, etc.

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LUZERNE HARD RUBBER—The Luzerne Rubber Co., Trenton, N. J. Hard rubber, thermoplastic; furnished in sheets, rods or tubes, for molding and machining into parts; high polish; corrosion resistant to acids and alkalies; dielectric strength 6 x 10^7 megohms constant at 22.8 degrees Cent.; tensile strength 3500-9000 lbs. per sq. in.; heat resistant to 120 degrees Fahr.; available in some colors; specific gravity 1.24; compressive strength 8000-12,000 lbs. per sq. in. Used for molded machine parts.

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MAKALOT—Makalot Corp., Boston. Synthetic resinous base; furnished in powder form and also as varnish and sheet, for molding into parts; high tensile and dielectric strength; low moisture absorption; heat, shock and abrasion resistant; nonflammable; flowing and covering characteristics eliminate sticking troubles.

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MARBLETTE—Marblette Corp., Long Island City, N. Y. Cast phenolic resin furnished in sheets, rods, tubes and special castings to be fabricated into finished form; colors; opaque and translucent; mottled or plain; also "Crystle" (water-clear transparent); nonflammable; insoluble; infusible; noncorrosive; odorless; high tensile and dielectric strengths; high polish; easily machined.

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MEISSNER—Meissner Mfg. Co., Mt. Carmel, Ill. Phenolic base, thermoplastic, for molding into parts; corrosion resistant; nonflammable; high polish; low moisture absorption. Used for insulators, handles, bushings, gears and bearings.

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MICABOND — Continental-Diamond Fibre Co., Newark, Del. Fibrous, flexible material; furnished in sheets and tubing, for machining and forming into parts; heat resistant; high dielectric strength; low moisture absorption. Used for V-rings, washers, segments and various special shapes.

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MICANITE — Mica Insulator Co., New York. Hard, semirigid sheet of built-up mica, which retains the heat resistant and high dielectric properties of mica. Readily machined, punched or molded for such parts as commutator rings, segments, tubes, spools, etc.; also as paper or cloth base tape and flexible plate for cold molding.

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MICARTA—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Phenolic base, thermosetting; furnished in laminated sheet, rods and tubes, for machining or punching into parts; dielectric strength 150-700 volts per mil; moisture absorption .5-5 per cent in 24 hrs.; resistant to shock, corrosion; high polish; flexible; tensile strength 7000-16,000 lbs. per sq. in.; available in colors. Used for bearings, gears, thermal and electrical insulation and parts exposed to acids, alkalies and common solvents.

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MONSANTO—Monsanto Chemical Co., Plastics Div., Springfield, Mass.

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Cellulose nitrate; thermoplastic; furnished in sheets, rods and tubes, or in laminated form, for machining, molding, stamping, swedging or blowing (steam) into parts; corrosion resistant; translucent; available in colors; flexible; dielectric strength 750-900 volts per mil; tensile strength 6000-9000 lbs. per sq. in.; low moisture absorption. Used for sight glasses, safety glass, oilproof insulation, dial covers, knobs, handles and structural models for strain study.

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Cast phenolic; thermosetting; furnished in sheets, rods and tubes, or laminated form; for casting and machining into parts; translucent; dielectric strength 250-700 volts per mil; corrosion resistant; tensile strength 6000-11,000 lbs. per sq. in.; high polish; moisture absorption .05-.07 per cent; available in colors. Used for safety shields, clock and radio cases, electrically insulated knobs and handles and structural models for strain study.

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Cellulose acetate; thermoplastic; furnished in sheet, laminated and powder forms or rods and tubes, for molding, machining, stamping or swedging into parts; resistant to corrosion; transparent; available in colors; flexible; tough; high polish; dielectric strength 540-1800 volts per mil; tensile strength 6000-6800 lbs. per sq. in. Used for safety glass, and compressible shims, couplings, gaskets, electrically insulated knobs and handles, molded shapes of all descriptions.

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Butvar and Formvar; polyvinyl acetal thermoplastic; furnished in resin, molding powder or sheet form; extremely tough from freezing temperatures to over 120 degrees Fahr.; sheet has great flexibility and rubberiness; dielectric strength 800 volts per mil. Used for safety glass, gaskets, adhesives, molded shapes.

1—Corrosion resistance; 2—High heat resistance; 3—Impact resistance; 4—High tensile strength; 5—High dielectric strength; 6—Nonflammable; 7—Takes high polish; 8—Translucence; 9—Available in colors; 10—Low moisture absorption

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MONSANTO RESINOX—Monsanto Chemical Co., Plastics Division, Springfield, Mass. Phenolic molding compounds, in standard and special formulas, thermosetting; heat-resistant; specific gravity 144; flexural strength 9200 lbs. per sq. in.; tensile strength 6800 lbs. per sq. in.; impact strength 2.5 ft. lbs. per sq. in.; water absorption .63 per cent by weight. Used in electrical equipment, large housings, radio cabinets, etc.

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NATIONAL CARBON — National Carbon Co. Inc., Cleveland. Carbon or graphite in amorphous or graphite form; made in a variety of shapes; molded, extruded or machined into parts. In graphitic form carbon possesses excellent lubricating properties; highly resistant to most acids, alkalies and solvents. Used for sleeve bearings, packings, threaded parts, nozzles for corrosive liquids, etc.

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NATIONAL FIBRE—National Vulcanized Fibre Co., Wilmington, Del. Converted cotton cellulose, chemically pure, tough horn-like material; furnished in hard or flexible form in sheets, rolls, tubes, rods and fabricated shapes; high dielectric and mechanical strengths; resistant to abrasion and shock; easily formed and machined; light in weight. Used for gears, valve disks, gaskets, washers, bobbin heads, electrical insulation, etc.

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NATIONAL SWITCH INSULATION—National Vulcanized Fibre Co., Wilmington, Del. Combination laminated Bakelite core with vulcanized fiber surfaces; available in sheets and fabricated shapes; high tracking (arc) resistance combined with rigidity and minimum warpage; high dielectric and mechanical strengths; low moisture absorption; easily stamped and fabricated. Used in switches to support and insulate current-carrying parts.

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NEILLITE—Watertown Mfg. Co., Watertown, Conn. Phenolic base, thermosetting; molded into parts; high tensile and dielectric strengths; corrosion resistant. Used for mechanical and electrical purposes.

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NEOPRENE—E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Chloroprene rubber; available as hose, wire, cable, sheets, tank linings, gaskets, packing, tubing, belting, industrial truck tires and molded goods. Used as binder for cork and asbestos. Is employed to impregnate or coat canvas, duck or other fabrics. Strength, abrasion resistance, resilience and elasticity of rubber; resistance to deterioration from contact with oils, greases, gasoline, heat, chemicals, sunlight and ozone; corrosion resistant; will not support combustion; low moisture absorption; tensile strength 4000 lbs. per sq. in.; available in colors. Used for machine applications where rubber characteristics are required but where the product is to be subjected to deteriorating influences.

See advertisement, Page 9-D

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NIGRUM—Bound Brook Oil-less Bearings Co., Bound Brook, N. J. Impregnated wood bushings, bearings and washers.

See advertisement, Page 12-D

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OHMOID—Wilmington Fibre Specialty Co., Wilmington, Del. Phenolic base, thermosetting; furnished in laminated sheets, rods and tubes, for machining or stamping into parts; dielectric strength 200-700 volts per mil; moisture absorption 2 per cent; insoluble in ordinary solvents; high polish; corrosion resistant; tensile strength 10,000-14,000 lbs. per sq. in.; heat resistance 250-300 degrees Fahr. Used for electric and mechanical insulation.

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O-I—FIBERGLAS — Owens-Corning Fiberglas Corp., Toledo, O. Glass; furnished in mineral wool form; nonflammable; light in weight; high insulating value; resistant to corrosion; low moisture absorption; downy white in color. Used between walls for insulation purposes and as filters in air-conditioning equipment.

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PANELYTE—The Panelyte Corp., New York. Synthetic laminated resin, supplied in sheet, rod, tube and molded form; also fabricated to size; good mechanical strength; resistant to acids and alkalies; low moisture absorption; lightweight; specific gravity 1.38. Used for refrigerator breaker strips, radio and electrical insulation, gears, pinions and structural parts; also in decorative grades for table tops, panels, etc.

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PEERLESS—National Vulcanized Fibre Co., Wilmington, Del. Converted cotton cellulose, chemically pure, fish paper insulation; furnished in sheets and rolls; high dielectric strength combined with toughness, springiness and good bending properties. Used extensively for generator and motor insulation and various electrical applications.

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PENN—Penn Fibre & Specialty Co., Philadelphia.

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Vulcanized fibre; cotton rag paper base; furnished in sheets, rods or tubes for machining and stamping into parts; tensile strength 12,000-15,000 lbs. per sq. in.; compressive strength 38,000-42,000 lbs. per sq.in.; shearing strength 9000-13,000 lbs. per sq. in.; heat resistant to 650 degrees Fahr.; dielectric strength 200-400 volts per mil; specific gravity 1.36-1.46; flexible; insoluble in ordinary solvents; available in color. Used for washers, shims, gears, bases, knobs, gaskets and insulating parts.

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Phenol fibre; a phenolic treated paper or canvas and linen; furnished in laminated sheet, rods or tubes for machining and stamping into parts; specific gravity of paper base 1.36, fabric base 1.38; water absorption of paper base .4-.8, fabric base .4-.6 at 24 hours immersion; resistance to heat, paper base 125 degrees Cent., fabric base 110 degrees Cent.; safe limit for constant pressure, paper base 257 degrees Fahr., fabric base 230 degrees Fahr.; tensile strength, ult. paper base 14,000 los. per sq. in., fabric base 10,000 lbs. per sq. in.; dielectric strength, volts per mil, paper base 450, fabric base 225 on ⅛-inch thickness, paper base 700 and fabric base 500 on 1/32-inch thickness; shatterproof. Used for washers, gears, shims, bearings, gaskets, disks, insulation, etc.

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PHENOLITE—National Vulcanized Fibre Co., Wilmington, Del. Laminated Bakelite; furnished with base of paper, cloth or asbestos in sheets, rods, tubes and fabricated shapes; also laminated with rubber sheet; high dielectric and mechanical strengths; low moisture absorption; heat resistant; infusible; resistant to acids, solvents and oils; high resistance to wear and impact; machinable. Used in electrical, mechanical and chemical applications for silent gears, bearings, bushings, washers, valve disks, terminal strips, etc.

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PLASKON—Plaskon Co. Inc., Toledo, O. Urea formaldehyde base, thermosetting; furnished in powder form, for molding into parts; translucent; tensile strength 8000-13,000 lbs. per sq. in.; available in colors; corrosion resistant; high polish; dielectric strength 270 volts per mil; heat resistance 167 degrees Fahr.; resistant to shock; moisture absorption 1-2 per cent. Used for housings, trim, knobs, dials, etc.

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PLASTACELE—E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Cellulose acetate base, thermoplastic; furnished in powder, sheets, rods and tubes, for machining and molding into parts; available in colors; transparent; resistant to shock; high polish; corrosion resistant; flexible; dielectric strength 700-1000 volts per mil; tensile strength 3000-8000 lbs. per sq. in.; heat resistance 185-250 degrees Fahr. Used for machine guards, models, control panels, dials, knobs, steering wheels, safety glass screens, etc.

See advertisement, Page 9-D

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PLEXIGLAS—Rohm & Haas Co. Inc., Philadelphia. Acrylic base, thermoplastic; furnished in sheets and rods; corrosion and shock resistant; transparent; flexible; specific gravity 1.18; tensile strength 7000-9000 lbs. per sq. in.; available in colors; high polish. Used for unbreakable inspection windows.

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PLYMETAL — Haskelite Mfg. Co., Chicago. Waterproof plywood, sheet metal bonded to one or both faces; has stiffness, rigidity; lightweight; metal on both faces insuring freedom from warpage. Types available for different purposes are galvannealed steel, stainless steel, aluminum, copper, chrome zinc, chrome steel, porcelain, etc. Used in automotive and aircraft fields.

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POLAROID—The Polaroid Corp., Boston. Light-polarizing glass and film. Principal property is 99.5 per cent polarization of transmitted light, uniformly over large area. Used for camera filters, polarizing attachments of microscopes, refractometers and other scientific instruments. Also for model structures to determine strain, three-dimensional motion picture apparatus, glareless auto headlights, etc.

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PRYSTAL—Catalin Corp., New York. Phenolic base, thermosetting; furnished in sheets, rods or special castings; nonflammable; translucent; low moisture absorption; high dielectric strength; corrosion resistant; high refractory index. Used to replace glass.

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PYRALIN—E. I. du Pont de Nemours & Co. Inc., Wilmington, Del. Nitrocellulose base, thermoplastic; furnished in sheets, rods and tubes, for machining into parts; transparent; available in colors; shock and corrosion resistant; high polish; flexible; dielectric strength 300-750 volts per mil; tensile strength 5000-10,000 lbs. per sq. in. Used for handles, gage glasses, instrument covers, models, safety glass screens, etc.

See advertisement, Page 9-D

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PYREX—Corning Glass Works, Corning, N. Y. Trademark indicating manufacture by above. Heat and chemical resistant; special technical glass parts supplied under this designation have also high dielectric strength, no moisture absorption and nonflammability.

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PYROFLEX—Maurice A. Knight, Akron, O. Depolymerized colloidal resin base, thermoplastic; furnished in lump or sheet form; applied by dipping or flame cementing sheets to parts; corrosion resistant; high dielectric strength; low moisture absorption. Good bonding material where temperatures are not too high.

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PYROPLAX—Cutler-Hammer Inc., Milwaukee. Asbestos base; furnished in cold-molded pieces; heat resistance 800-1000 degrees Fahr.; nonflammable; dielectric strength 40 volts per mil; resistant to corrosion and abrasion. Used for machine parts where high temperature resistance to high temperature and electric arc is required.

R

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RESILON—United States Stoneware Co., Akron, O. Resinous thermoplastic; furnished in sheets and lumps to be molded and cast into machine parts; corrosion resistant; flexible; high dielectric strength; tensile strength; heat resistant; shatterproof. Used for lining parts to resist corrosive attack.

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RESISTOFLEX PVA — Resistoflex Corp., New York. Polyvinyl alcohol base, furnished in laminated sheet, rods, tubes or hose, to be molded, cast, machined, stamped and ex-

1—Corrosion resistance; 2—High heat resistance; 3—Impact resistance; 4—High tensile strength; 5—High dielectric strength; 6—Nonflammable; 7—Takes high polish; 8—Translucence; 9—Available in colors; 10—Low moisture absorption

truded into parts; corrosion, abrasion and heat resistant; nonflammable; available in color; translucent; high tensile strength. Used for hose, gaskets and seals for fuel and lubricating units, hydraulic mechanisms and controls, oil filters, air conditioning units, refrigerant purging lines, chemical solvent hose, fire extinguisher hose, etc.

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REVOLITE—Atlas Powder Co., Zapan Div., Stamford, Conn. Cloth base impregnated with Bakelite resin; furnished in either laminated or single ply form; heat resistant; high dielectric strength; corrosion resistant; low moisture absorption; impact resistant. Used for cable wrappings, diaphragms for pumps and valves, gaskets and flexible connections for machinery such as pulverizers.

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ROBERTSON FELT BONDED METAL—H. H. Robertson Co., Pittsburgh, Pa. and Felters Co. Inc., Boston. Felt bonded to metal making permanent bond; felt may be on one or both sides of metal, and metal may be bent or twisted without destroying bond; corrosion resistant; high tensile strength; nonflammable; available in colors; low moisture absorption. May be surfaced with wood veneers, plastics, paint, etc.

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RUB-EROK — Richardson Co., Indianapolis. Special rubber furnished in sheet form to be molded; can be highly polished; corrosion resistant; flexible; high dielectric strength; low moisture absorption. Used for electrical insulation.

See advertisement, Page 59-D

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RUB-TEX—The Richardson Co., Indianapolis. Hard rubber; molded into parts, particularly desirable for electrical, heat and cold insulation; adapted to many industrial uses.

See advertisement, Page 59-D

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RYERTEX—Joseph T. Ryerson & Son Inc., Chicago. A nonmetallic bearing material designed for use with water lubrication primarily; high shock resistance; suitable for bearing loads to 5000 lbs. per sq. in.; resistant to acids and mild alkalies.

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SELFVULC—Self-Vulcanizing Rubber Co. Inc., Chicago. Self, cold curing gum rubber; furnished in plastic or liquid form; resistant to corrosion and abrasion; tensile strength 2000 lbs. per sq. in.; resistant to shock; flexible; heat resistance 212 degrees Fahr.; low moisture absorption; available in colors. Used in machines as a sound deadener, insulation and waterproofing.

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SIRVENE—Chicago Rawhide Mfg. Co., Chicago. Synthetic rubber compounds molded into parts; resistant to oils and heat, oxidation and weather. Used for sealing oils and greases, packings, gaskets, covers and special parts.

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SIRVIS—Chicago Rawhide Mfg. Co., Chicago. Special tanned abrasive and heat resisting leather. Used for all types of packings, gaskets and mechanical leather parts.

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SPAULDING ARMITE — Spaulding Fibre Co. Inc., Tonawanda, N. Y. Fibrous material; furnished in sheets and laminated forms for machining, stamping or forming into parts; flexible; dielectric strength 200-550 volts per mil; compressive strength 40,000 lbs. per sq. in.; abrasion and corrosion resistant; tensile strength 9000-15,000 lbs. per sq. in.; available in colors; high polish.

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SPAULDING FIBRE—Spaulding Fibre Co., Inc., Tonawanda, N. Y. Fibrous material; furnished in sheet and laminated forms or rods and tubes, for machining, stamping or forming into parts; dielectric strength 150-400 volts per mil; tensile strength 9000-15,000 lbs. per sq.in.; flexible; abrasion and corrosion resistant; available in colors; resistant to shock. Used for mechanical applications where toughness, light weight and machining and forming properties are essential.

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SPAULDITE—Spaulding Fibre Co. Inc., Tonawanda, N. Y. Phenolic base, thermosetting; furnished in sheet and laminated rods and tubes for machining or stamping into parts; dielectric strength 700 volts per mil; low moisture absorption; high polish; corrosion and heat resistant (220 degrees Fahr.); resistant to shock. Used where resistance to moisture and chemicals, appearance and permanence are essential.

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SPAULDO—Spaulding Fibre Co. Inc., Tonawanda, N. Y. Fibrous material; furnished in sheet form for machining or stamping into parts; flexible; dielectric strength 300 volts per mil; heat resistance 220 degrees Fahr.; high polish; corrosion resistant; tensile strength 8000-16,000 lbs. per sq. in.; resistant to shock. Used for applications where flexibility and toughness in both grain directions are essential.

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STYRON A-50 and A-200—The Dow Chemical Co., Midland, Mich. Thermoplastic; furnished in powder for molding, casting and machining; abrasion resistant, high polish; corrosion resistant; dielectric strength 5000 volts per mil at 1 mil, 500 volts per mil at 125 mil; tensile strength, ult., to 10,000 lbs. per sq. in.; low moisture absorption; nonflammable; available in color; transparent. Used for insulators, decorative articles, structural parts, etc.

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SURCO-SOFLEX TUBING — Surprevant Electrical Insulation Co., Boston. Flexible insulating tubing; high dielectric and tensile strength; oilproof, ozoneproof; nonageing; resists oxidation and moisture; unaffected by acids, alkalies, organic solvents and many other chemicals. Used for automotive, aircraft, radio, telephone, telegraph electric meter and signaling apparatus, motors, generators, etc.

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SYNTHANE—Synthane Corp., Oaks, Pa. Laminated Bakelite; furnished in sheets, rods, tubes and fabricated parts; corrosion resistant; high tensile strength; low moisture absorption; dielectric strength. Used for gears, panels, bushings insulation, washers and vibration dampening devices.

T

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TAYLOR FIBRE—Taylor Fibre Co., Norristown, Pa. Phenolic base, thermosetting; furnished in laminated sheet, rods or tubes for machining into parts; high polish; flexural strength 12,000-16,000 lbs. per sq. in.; dielectric strength 500 volts per mil; tensile strength 5000-9000 lbs. per sq. in.; heat resistance 300 deg. Fahr.; low moisture absorption; available in colors; impact resistant; brinell hardness 35-45. Used for gears, and insulating and binding material against moderate temperatures.

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TEGIT—Garfield Mfg. Co., Garfield, N. J. Brown or black plastic; corrosion resistant; high dielectric strength; low moisture absorption; heat resistance 300 degrees Fahr.; high polish; resists hot oil, boiling water and ordinary chemicals; will not shrink, crack, warp or deteriorate with age. Used for wiring devices and small insulated parts.

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TEGOWOOD—Resinous Products & Chemical Co. Inc., Philadelphia. Phenolic resin and thin wood veneer; furnished in laminated form for curing in hot presses to simple blocks or panels, then cut; corrosion resistant; slightly flexible; high tensile strength; heat resistant; low moisture absorption; shatterproof; high compressive strength. For use in nonmetallic gears, collars, etc.

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TENITE—Tennessee Eastman Corp., Kingsport, Tenn.

I; cellulose acetate base, thermoplastic; furnished in granular and molding sheet form; available in clear transparent and colors, plain, variegated, translucent and opaque; high impact strength; high polish. Used for injection molding decorative and industrial products.

II; cellulose acetate butyrate base, thermoplastic; furnished in granular and molding sheet form; has greater dimensional stability than cellulose acetate plastic because of lower moisture absorption; contains less plasticizer than cellulose acetate plastic and the plasticizer used has greater retentivity; available in clear transparent and colors; plain, variegated, translucent and opaque; high impact strength; high polish. Used for injection molding of decorative and industrial products.

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TEXTOLITE — General Electric Co., Plastics Dept., Pittsfield, Mass. Phenolic base, thermosetting; furnished in sheets, laminated forms, and rods or tubes molded into parts; resistant to corrosion; tensile strength 5000-20,000 lbs. per sq. in.; resistant to shock; dielectric strength 60-1000 volts per mil; heat resistance 266-400 degrees Fahr.; available in color; translucent in certain grades; high polish. Used for electrical or thermal insulation, structural parts, gears, cams, bearings, housings, knobs, etc. Material is available in several forms, each having slightly different properties.

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Cold Molded—Two types: nonrefractory material containing asphalt as a binder and asbestos as a filler and refractory containing cement and drying oils as a binder with an asbestos filler; cold molded at room temperatures and heat treated for strength and toughness; corrosion resistant; heat and arc resistant. Not recommended for parts requiring high dielectric strength or thin sections.

See advertisement, Page 4-D

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THERMOPLAX—Cutler-Hammer, Inc., Milwaukee. Bituminous base compounded with filler such as asbestos; cold-molded into parts; heat resistance 400-600 degrees Fahr.; nonflammable; dielectric strength 80-100 volts per mil; resistant to corrosion; high polish; tensile strength 2000-4000 lbs. per sq. in.; moisture absorption 2 per cent. Used for electrical and heat insulation.

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THIOKOL—Thiokol Corp., Trenton, N. J. Synthetic rubber, available in two types; furnished in powder or raw sheet form, corresponding to crude rubber; processed in manner similar to rubber; oil, corrosion and shock resistant. Used for hoses carrying oil or gasoline, gaskets, packing, pipeline rings, diaphragms, newspaper printing blankets, etc.

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TRANSITE—Johns-Manville, New York. Fireproof material in a variety of forms as hoods, dampers, baffles, electrical conduits where high dielectric strength is not required; resistant to corrosion; heat resistant; nonflammable.

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TYGON—United States Stoneware Co., Akron, O. Resinous thermoplastic; furnished in sheet, rod or tube form, for molding and extruding into parts; abrasion, heat, impact, and corrosion resistant; flexible; high dielectric and tensile strength; low moisture absorption; available in color; shatterproof; translucent. For use in oil and corrosion resistant coverings, gaskets, tubing, etc.

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UNISORB — Felters Co. Inc., Boston. Proper types of felt with or without vibration units accordingly to job for vibration isolation and acoustical work; corrosion resistant; flexible; shatterproof; available in colors.

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UNYTE—Plaskon Co. Inc., Toledo, O. Urea-formaldehyde base, thermosetting; translucent; low moisture absorption; nonflammable; available in colors; free flowing; capable of rapid cure.

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VB-114—Dow Chemical Co., Midland, Mich.

1—Corrosion resistance; 2—High heat resistance; 3—Impact resistance; 4—High tensile strength; 5—High dielectric strength; 6—Nonflammable; 7—Takes high polish; 8—Translucence; 9—Available in colors; 10—Low moisture absorption

Crystaline, fiberous, aliphatic chloride, polymer base, thermoplastic; furnished in powder and fiber for molding and stamping into parts; abrasion resistant; high polish; corrosion resistant; very tough and flexible; dielectric strength, to 4000 volts per mil at 1 mil; tensile strength, ult. 60,000 lbs. per sq. in. (extruded); low moisture absorption; nonflammable; available in color; shatterproof; translucent to transparent. Used for gaskets, packing, lines, fittings, tubing, belting, etc.

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VIBRACORK—Armstrong Cork Products Co., Lancaster, Pa. Resilient board of cork granules; compressed and baked under pressure; long life and high resistance to deterioration. Material is made in three densities for vibration dampening applications.

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VIBRO-PLATE—Korfund Co. Inc., Long Island City, N. Y. Material has permanent elastic core, consisting of a combination of several resilient elements; corrosion and shock resistant; low moisture absorption. Used for pads to be placed under legs or bases of machines.

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VICTOPAC—Victor Mfg. & Gasket Co., Chicago. Laminated sheet packing with asbestos base for stamping or cutting by hand into parts; high corrosion resistance; flexibility; tensile strength 2500 lbs. per sq. in.; heat resistant; low moisture absorption; nonffammable; impact resistant; high compressive strength. Used for gasketing and packing.

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VICTOPRENE—Victor Mfg. & Gasket Co., Chicago. Synthetic plastic, thermosetting; furnished in sheet or laminated form, for molding, stamping and blanking into parts; corrosion and heat resistant; tensile strength 1000 lbs. per sq. in.; low moisture absorption; nonflammable; shatterproof. Used as a gasketing material.

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VICTOR Victor Mfg. & Gasket Co., Chicago.

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Asbestos sheet, asbestos fiber base; furnished in sheets for stamping or cutting into parts; corrosion resistant; flexible; tensile strength 300 lbs. per sq. in.; heat resistance 700 degrees Fahr.; nonflammable; specific gravity .9; high compressive strength; insoluble; some resilience. Used for packing, thermal insulation, and vibration absorption.

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Cork sheet; vegetable bark in sheet form for stamping and cutting into parts; corrosion resistant; flexible; heat resistance 180 degrees Fahr.; low moisture absorption; specific gravity .27; fair compressive strength; resilient. Used for fluid seals and vibration absorption.

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VICTORITE—Victor Mfg. & Gasket Co., Chicago. Vegetable fiber base, sheet packing; furnished for stamping or cutting by hand into machine parts; flexible; tensile strength 3000 lbs. per sq. in.; heat resistance 200 degrees Fahr.; nonflammable; impact resistant; specific gravity .675; compressive strength 2000 lbs. per sq. in.; resilient. Used for gasketing and packing.

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VINYLITE—Carbide & Carbon Chemicals Corp., New York.

Unfilled V Series; conjoint polymer of vinyl chloride and vinyl acetate base, thermoplastic; furnished in sheets, rods or tubes and powder for molding, machining, heat forming, stamping or extruding into parts; corrosion resistant; high polish, flexible; available in colors; nonflammable; moderate tensile strength; dielectric strength 6000-12,000 volts per mil. Used for machine cabinets, electrical fixtures, transparent windows, etc.

Resins; polyvinyl acetates, chlorides and acetals, thermoplastic; furnished in sheets, rods or tubes and powder, for molding and stamping into parts; corrosion resistant; nonflammable; flexible; high polish; available in colors; translucent; moderate tensile strength; dielectric strength 650 volts per mil; resistant to water, acids and alkalies. Uses include chrome-plating barrel liners, lacquers, dials and laminating adhesives.

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VITRIC-10—United States Stoneware Co., Akron, O. Ceramic base, nonplastic; furnished in powder form for casting into parts, or as complete parts; corrosion and heat resistant (1000 degrees Fahr.); nonflammable; compressive strength 3500 lbs. per sq. in.; dielectric strength 40 volts per mil; available in colors. Used for cementing and sealing.

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VULCABESTON—Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. Hard rubber and asbestos base, thermosetting; furnished in sheet and laminated forms or rods and tubes for machining into parts or supplied as complete parts; heat resistance 750 degrees Fahr.; tensile strength 7000 lbs. per sq. in.; dielectric strength 40 volts per mil; corrosion resistant; low moisture absorption. Uses include insulation, brake linings, valve disks, gaskets, and packings.

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VULCOID—Continental-Diamond Fibre Co., Newark, Del. Resinous base, thermoplastic; furnished in sheets and laminated forms, or rods and tubes for machining, stamping or forming into parts; low moisture absorption; dielectric strength 400 volts per mil; tensile strength 11,000 lbs. per sq. in.; resistant to abrasion; flexible in some forms; heat resistant 275 degrees Fahr.; available in red, gray, black; shatterproof. Used for electrical insulation where arc resistance is important. For mechanical insulation where moderate moisture resistance is important.

W

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WESTFELT — Western Felt Works, Chicago. Felt material; furnished in cut shapes according to user's specifications; for vibration dampening, deadening sound, insulating against heat and cold and filtering liquids, air and gases; also furnished as oil or dust seals for bearings.

See advertisement, Page 57-D

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WILMINGTON FIBRE—Wilmington Fibre Specialty Co., Wilmington, Del. Cotton rag and paper, chemically treated, nonplastic material; furnished in sheet form or rods and tubes for machining or stamping into parts; dielectric strength 200-400 volts per mil; tensile strength 12,000-15,000 lbs. per sq. in.; resistant to shock and corrosion; high polish; available in colors. Used for electrical and mechanical insulation.

1—Corrosion resistance; 2—High heat resistance; 3—Impact resistance; 4—High tensile strength; 5—High dielectric strength; 6—Nonflammable; 7—Takes high polish; 8—Translucence; 9—Available in colors; 10—Low moisture absorption

Alphabetical Listing of Producers of Design Materials

Section I—Iron, Steel and Nonferrous Metals

A

Acme Steel Co., 2840 Archer Ave., Chicago.
Stainless strip steels—ACME

Allegheny-Ludlum Steel Corp., Oliver Bldg., Pittsburgh.
Stainless steels—ALLEGHENY, ALLEGHENY METAL
Special alloy tool steels—ATLAS No. 93, PYTHON, SEMINOLE, TETON
Nondeforming tool steel—DEWARD
Carbon tool steel—POMPTON
Abrasion resistant alloys—DRAGON, TIOGA
Electrical steels — ALLEGHENY-LUDLUM, MUMETAL and OHMALOY.

Alloy Cast Steel Co., Marion, O.
Cast alloy steels—CAST ALLOY STEELS

Aluminum Co. of America, 634 Gulf Bldg., Pittsburgh.
Aluminum alloys—ALCOA

Aluminum Industries Inc., 2438 Beekman St., Cincinnati.
Aluminum base alloys—PERMITE

American Brass Co., Waterbury, Conn.
Aluminum brass alloy—AMBRALOY
Copper-aluminum alloy—AVIALITE
Copper, aluminum and nickel alloy—TEMPALOY
Corrosion resistant alloys—AMBRAC, TOBIN BRONZE, ANACONDA EVERDUR, MUNTZ METAL

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
Magnesium alloys—MAZLO

American Manganese Steel Div., The American Brake Shoe & Foundry Co., Chicago Heights, Ill.
Cast steels and welding rods—AMSCO

American Nickeloid Co., 23 Second St., Peru, Ill.
Refinished bonded sheet and strip—NICKELOID, CHROMALOID, BRASSOID, COPPEROID, AMERICAN BONDED METALS

American Rolling Mill Co., Middletown, O.
Stainless and high tensile steels—ARMCO
High silicon steel—ARMCO TRAN-COR 60
Pure iron—ARMCO Ingot Iron
Galvanized sheet iron or steel—ZINC-GRIP

American Smelting & Refining Co., Equitable bldg., New York.
Cadmium-nickel bearing alloy—ASAR-COLOY NO. 7

American Steel Foundries, 410 N. Michigan Ave., Chicago.
High strength cast steel—HYLASTIC

Ampco Metal Inc., 3830 West Burnham St., Milwaukee.
Corrosion and shock resistant alloys—AMPCO METAL
Copper base alloys—AMPCOLOY

Amplex Mfg. Co., Div. of Chrysler Corp., 6500 Harper Ave., Detroit.
(See Chrysler Corp.)

Anchor Drawn Steel Co., Latrobe, Pa.
High carbon steel—RED ANCHOR

Apex Smelting Co., 2554 Fillmore St., Chicago.
Zinc base die cast alloy—APEX

Apollo Steel Co., Apollo, Pa.
Copper-bearing steel—APOLLOY METAL

Aurora Metal Co., 614 West Park Ave., Aurora, Ill.
Aluminum bronze alloy—AUROMET

B

Babcock & Wilcox Co., 19 Rector St., New York.
Corrosion and heat resisting alloys—ADAMANTINE, ELVERITE

Babcock & Wilcox Tube Co., Beaver Falls, Pa.
Corrosion and heat resisting steel tubes—B & W CROLOY

Baker & Co. Inc., 54 Austin St., Newark, N. J.
Platinum alloy—BAKER, PLATINUMCLAD

Bearium Metals Corp., 258 State St., Rochester, N. Y.
Bearium-processed lead alloys—BEARIUM

Beckett Bronze Co., Muncie, Ind.
High lead bronze—BECKETT METAL

Belle City Malleable Iron Co., Racine, Wis.
Pearlitic malleable iron—BELMALLOY

Bethlehem Steel Co., Bethlehem, Pa.
Corrosion resistant alloy steels—BETHADUR
Copper bearing steel—BETH-CU-LOY
Stainless steel—BETHALON
High carbon, manganese and nickel steels; and chromium-molybdenum steel castings—BETHLEHEM
High temperature alloy steel—SUPERTEMP
Nickel-chromium steels—MAYARI

Binney Castings Co., 2555 Dorr St., Toledo, O.
Heat resisting iron alloys—MIN-OX

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Alloy cast steels—BIRDSBORO

Bohn Aluminum & Brass Corp., Lafayette Bldg., Detroit.
Light aluminum alloy—BOHNALITE

Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Bearing bronzes—BOUND BROOK, COMPO

Bridgeport Brass Co., Bridgeport, Conn.
High copper silicon bronzes—DURONZE
Copper and zinc alloys—BRIDGEPORT

Bronze Die Casting Co., Franklin St. and Ohio River, Pittsburgh.
High tensile, acid resistant alloy—ALBRO METAL, B. D. METAL

Buckeye Brass & Mfg. Co., 6410 Hawthorne, Cleveland.
Bearing bronzes—COMMERCIAL, HYSPEED, LUBRICO

Buffalo Foundry & Machine Co., Buffalo
Corrosion and heat resistant alloy—BUFLOKAST

Bunting Brass & Bronze Co., Spencer and Carlton Sts., Toledo, O.
Bearing bronzes—BUNTING

Burgess-Parr Co., Freeport, Ill.
Acid resisting alloys—ILLIUM

C

Cadman, A. W., Mfg. Co., 2816 Smallman St., Pittsburgh.
Nickel bronze alloy—NICUITE
Babbitt metal—BEARITE, ACORN
Copper alloy—CUPALOY

Campbell, Wyant & Cannon Foundry Co., Muskegon Heights, Mich.
High strength cast irons — CANNONITE, PROFERALL

Cannon-Stein Steel Corp., Marcellus and Wyoming Sts., Syracuse, N. Y.
Manganese and chromium nickel steels—RITA
Corrosion and heat resistant alloy—CANNON 3½ per cent nickel steel

Carboloy Co. Inc., 2985 E. Jefferson Ave., Detroit.
Cemented carbide—CARBOLOY

Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh.
Abrasion resisting alloy—U. S. S. AR STEEL, U. S. S. CARILLOY ALLOY STEELS

Carpenter Steel Co., Reading, Pa.
Carbon, chromium and chromium nickel steels —CARPENTER

Cerro de Pasco Copper Corp., 44 Wall St., New York.
Bismuth-lead-tin-antimony castings — CERROMATRIX, CERROBASE, CERROBEND

Chace, W. M., Co., 1616 Beard Ave., Detroit.
Thermostatic metal—CHACE THERMOSTATIC METAL

Chain Belt Co., 1604 W. Bruce St., Milwaukee.
High-tensile, corrosion-resistant alloy—REX Z METAL

Chambersburg Engineering Co., Chambersburg, Pa.
Nickel-molybdenum iron alloys—CECOLLOY, CECOLLOY IRON

Chapman Valve Mfg. Co., Indian Orchard, Mass.
Corrosion resisting iron—DAVIS METAL

Chase Brass & Copper Co., Waterbury, Conn.
Corrosion resistant copper alloys—OLYMPIC BRONZE, ANTIMONIAL, ADMIRALTY, CHAMET BRONZE, CHASE, 444 BRONZE

Chicago Steel Foundry Co., 3720 S. Kedzie Ave., Chicago.
Alloy cast steels—EVANSTEEL, PYRASTEEL

Chrysler Corp., Amplex Div., 6500 Harper Ave., Detroit.
Bearing bronze—OILITE

Cinaudagraph Corp., Stamford, Conn.
Nickel-aluminum-iron alloy—NIPERMAG

Climax Molybdenum Co., 500 Fifth Ave., New York.
Molybdenum steel—MO-LYB-DEN-UM

Colonial Alloys Co., Colonial Philadelphia Bldg., Philadelphia.
Corrosion resistant alloy—COLALLOY

Columbia Steel & Shafting Co., Woodkrik St., Pittsburgh, Pa.
High tensile steel—COLUMBIA

Continental Roll & Steel Foundry Co., East Chicago, Ind.
Hard alloys for rolls—DUQUESNE SPECIAL, CROMONITE, HUBBARD SPECIAL
Alloy cast steels—DYNAMIC STEEL MOLYBDENITE, TEMP ALLOY

Cooper Alloy Foundry Co., 159 Broadway, Elizabeth, N. J.
Corrosion and heat resisting—COOPER ALLOY

Cramp Brass & Iron Foundries Co., Philadelphia.
Copper alloys—CRAMP ALLOYS

Crucible Steel Co. of America, 405 Lexington Ave., New York.
High strength alloy steels—DUPLEX, MAXEL and SIMPLEX
Corrosion and heat resistant alloys—LO CRO .046, REZISTAL

D, E

Detroit Alloy Steel Co., Ft. of Iron St., Detroit.
Alloy steel castings—KROKOLOY, CASTALOY, MARTIN STEEL, FLAMALOY.
Oil hardening steel castings—CARBOMANG

Dochler Die Casting Co., 386 Fourth Ave., New York.
Copper-zinc-silicon alloys — DOLER-BRASS, DOLER-ZINK
Magnesium base alloys—DOLER-MAG
Aluminum base die castings—DOLER-ALUMIN

Dow Chemical Co., Midland, Mich.
Corrosion resistant light alloys—DOW-METAL

Driver-Harris Co., Harrison, N. J.
Corrosion, heat and wear resisting alloys — ADVANCE, NIREX, NILVAR, CHROMAX, CIMET, NICHROME, HYTEMCO, DRIVER-HARRIS 42 and 52 ALLOYS

Driver, Wilbur B., Co., Riverside Ave., Newark, N. J.
Nickel copper alloy—CUPRON
Nickel-chromium-iron—CROMIN D
Heat resistant wire—TOPHET

Duriron Co. Inc., Dayton, O. (and licensees—see Duriron in tradename listing).
Corrosion and heat resistant alloys—ALCUMITE, DURICHLOR, DURIMET, DURIRON, DURCO

Electro-Alloys Co., Elyria, O.
Corrosion resisting alloys—THERMALLOY

Electro Metallurgical Sales Corp., 30 East 42nd St., New York.
Ferro-alloy—ELECTROMET

Empire Metal Co., Syracuse, N. Y.
Corrosion and heat resistant alloy—PREMIER BABBITT

Erie Malleable Iron Co., Erie, Pa.
Abrasion and wear resisting malleable iron—ERMAL, ERMALITE

F, G

Farrell-Cheek Steel Co., Sandusky, O.
Abrasion resisting cast steel—FARRELL's 85

Federal Mogul Corp., 11031 Shoemaker Ave., Detroit.
Bearing bronzes—FEDERAL MOGUL
Babbitt bearing alloys—MOGUL

Ferner, R. Y., Co., 161 Devonshire St., Boston.
Corrosion and heat resisting alloys—ELINVAR
Alloy with low coefficient of expansion—INVAR

Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago.
Special alloy steel—MOLYBDIE

Firth-Sterling Steel Co., McKeesport, Pa.
Carbon tool steels—STERLING
Cemented carbides—FIRTHITE

Foote Bros. Gear & Machine Co., 5301 S. Western Ave., Chicago.
Nickel-molybdenum alloy—FIVEPOINT DEEP-HARD STEEL

Frontier Bronze Corp., 818 Elmwood Ave., Niagara Falls, N. Y.
Heat-resisting alloys—FRONTIER
Titanium-copper alloy—TI-COPPER NO. 39

General Alloys Co., 367-405 W. First St., Boston.
Corrosion, heat and wear resisting alloys—X-ITE, X-7, Q-ALLOYS, ECONOMET

General Electric Co., Schenectady, N. Y. (and licensees—see Alnico in tradename listing).
Magnet alloy—ALNICO
Welding electrode—TRODALOY NO. 1

Great Lakes Steel Corp., Div. of National Steel Corp., Ecorse, Detroit, Mich.
Impact-resistant alloy—DUCTILOY

H, I

Halcomb Steel Div., Crucible Steel Co. of America, Syracuse, N. Y.
Stainless steels—HALCOMB

Handy & Harman, 82 Fulton St., New York.
Brazing alloys — HANDY FLUX, SILFOS, EASY-FLO

Haynes Stellite Co., 205 E. 42nd St., New York.
Heat and wear resistant alloys—HAYSTELLITE, HAYNES STELLITE, HASCROME
Corrosion resistant alloy — HASTELLOY, HAYNES 93

Heppenstall Co., Hatfield St., Pittsburgh.
Abrasion resistant alloy steels—HARDTEM, KLEENKUT
High strength alloy steel—HEPPENSTALL, HEPPENSTALL 5H50, EIS45
Nickel chrome molybdenum steel—PYRODIE

Hevi Duty Electric Co., 4212 W. Highland Blvd., Milwaukee.
Heat resistant element—ALLOY NO. 10

Hills-McCanna Co., 2349 Nelson St., Chicago.
Bearing bronzes—HILLS McCANNA

Hoskins Mfg. Co., 4445 Lawton Ave., Detroit.
Heating element alloys—CHROMEL

Hybnickel Alloys Co., Wilmington, Del.
Nickel-chrome alloy—HYBNICKEL

Industrial Steels Inc., East Cambridge, Mass.
Stainless steels and irons — INDUSTRIAL, Nos. 35 and 12, respectively.

Ingersoll Steel & Disc Division, Borg-Warner Corp., 310 S. Michigan Ave., Chicago.
Stainless clad steel—INGACLAD

Inland Steel Co., 38 S. Dearborn St., Chicago.
High strength, corrosion resistant and copper bearing steels and spring steel—INLAND
Abrasion resisting steel—LEDLOY

International Nickel Co. Inc., 67 Wall St., New York (and licensees).
Corrosion, heat and wear resisting alloys—NI-TENSYLIRON, NI-HARD, NI-RESIST, NICKEL, MONEL, INCONEL

J, K, L

Jeffrey Mfg. Co., The, First Ave. and Big Four railroad, Columbus, O.
High strength malleable irons — PERDURO, SUPERMAL

Johnson Bronze Co., New Castle, Pa.
Bearing metals — JOHNSON, LEDALOYL, STEELBOND

Jones & Laughlin Steel Corp., Jones & Laughlin Bldg., Pittsburgh.
High tensile steel—JAL-TEN
Free machining steel—JALCASE
Forging steel—J & L CORRECT BALANCE

Koppers Co., Bartlett-Hayward Div., Baltimore.
Bronze alloy—D-H-S BRONZE

Lake City Malleable Co., 5060 Lakeside Ave., Cleveland.
Malleable iron—SHOCK PROOF

La Salle Steel Co., 150th and Magnolia, Hammond, Ind.
High-tensile alloy—STRESSPROOF NO. 2

Latrobe Electric Steel Co., Latrobe, Pa.
Nondeforming tool steel—MANGANO

Lebanon Steel Foundry, Lebanon, Pa.
Alloy cast steels—CIRCLE L

Lehigh Babbitt Co., Box 504, Allentown, Pa.
Graphite and babbitt metals—GRAPHO

Lincoln Electric Co., 12818 Coit Rd., Cleveland.
High tensile welding rods — SHIELDARC, LIGHTWELD, MANGANWELD, WEARWELD, HARDWELD, ABRASOWELD, TOOLWELD, AERISWELD, FLEETWELD, STAINWELD, CHROMEWELD, FERROWELD, SOFTWELD, ALUMINWELD, READYWELD, SURFACEWELD

Linde Air Products Co., 205 E. 42nd St., New York.
Welding rods—OXWELD

Link-Belt Co., 220 S. Belmont Ave., Indianapolis.
Malleable cast iron—PROMAL

Lumen Bearing Co., 207 Lathrop Ave., Buffalo.
Wear resisting—MACHINEBRONZE
High tin babbitt—STANNUM BABBITT
Lead base bearing babbitt—LOTUS BABBITT
Bearing alloys—LUMEN ALLOYS

M

Mackintosh-Hemphill Co., 901 Bingham St., Pittsburgh.
Wear resisting steel and iron—ADAMITE, ADAMITE IRON
Wear resisting iron—IRALITE
High strength alloy steel — MACHEMPITE "Wearprooft"

Magnolia Metal Co., 120 Bayway, Elizabeth, N. J.
Babbitt metal—ADAMANT SUPER-GENUINE BABBITT
Bearing bronze—MAGNOLIA

Mallory, P. R., & Co. Inc., Indianapolis.
Hard surfacing material—MAL-ARC
Welding electrodes—ELKALOY
Wear resistant alloy—ELKONITE
Copper base alloys—MALLORY

Manganese Steel Forge Co., Allen St. and Castor Ave., Philadelphia.
Forged alloy steel—ROL-MAN

Massillon Steel Casting Co., Massillon, O.
Alloy cast steel—MASSILLON, TIGERLOY
Nitriding steel—NITRALLOY

Maurath Inc., 7301 Union Ave., Cleveland.
Welding rod—MAURATH

McGill Mfg. Co., Valparaiso, Ind.
Corrosion resistant alloys—McGILL

Meehanite Metal Corp., Vandergrift Bldg., Pittsburgh (and licensees—see Meehanite in tradename listing).
Heat resisting alloy—MEEHANITE

Metal Carbides Corp., Youngstown, O.
Tungsten carbide metal—TALIDE

Metal & Thermit Corp., 120 Broadway, New York.
Welding electrodes—MUREX

Moraine Products Div., General Motors Corp., 1540 Wisconsin Blvd., Dayton, O.
Bearing alloys—DUREX, MORAINE

Morganite Brush Co. Inc., 3302 48th Ave., Long Island City, N. Y.
Carbon-graphite-metal—MORGANITE

Motor Castings Co., Milwaukee.
Nickel-chromium-molybdenum gray iron—MOCASCO 60

Mueller Brass Co., Port Huron, Mich.
Corrosion resisting alloys—TUFSTUFF, MUELLER 600 BRONZE
Brass for forging—RELLEUM BRASS

N

National Alloy Steel Division, Blawnox, Pa.
Corrosion resisting castings—NA, NA-1, NA-2

National Lead Co., 111 Broadway, New York.
Babbitt metal for bearings—DUTCH BOY BABBITT, HOYT BABBITT METAL

National Malleable & Steel Castings Co., 10600 Quincy Ave., Cleveland.
Alloy cast steel—NACO STEEL
Malleable cast iron—MALLIX
Chromium-manganese-carbon alloy—NUREX

National Tube Co., Frick Bldg., Pittsburgh.
Seamless steel tubing—NATIONAL TUBING

New Jersey Zinc Co., 160 Front St., New York.
Zinc alloy—ZAMAK, ZILLOY

Nicralumin Co., P. O. Box 1351, Wilmington, Del.
Light aluminum alloys—NICRAL

Nitralloy Corp., 230 Park Ave., New York (and licensees—see Nitralloy in tradename listing).
Nitriding steel—NITRALLOY

Nitricastiron Corp., 230 Park Ave., New York (and licensees—see Nitricastiron in tradename listing).
Cast iron—NITRICASTIRON

P

Phelps Dodge Copper Products Corp., 40 Wall St., New York.
High tensile silicon bronze—PMG METAL

Pioneer Alloy Products Co. Inc., 16601 Euclid Ave., Cleveland.
Nickel-chromium-molybdenum steel—PIONEER METAL

Potts Co., Horace T., E. Erie Ave. and D St., Philadelphia.
Chromium - molybdenum alloy — ELASTUF, CHRO-MOLY
Chromium-vanadium alloy—ELASTUF TYPE A
Carbon-manganese-silicon abrasion resisting steel—WEARTUF

Precision Castings Co. Inc., Syracuse New York.
Aluminum base alloys—PRECISION

R

Randall Graphite Products Corp., 609 W. Lake St., Chicago.
Graphite bronze bearings and bushings—RANDALL

Republic Steel Corp., Republic Bldg., Cleveland.
Open hearth iron alloy—TONCAN IRON
Stainless and heat resisting alloys—ENDURO
High strength alloy—REPUBLIC

Resisto-Loy Co., Grand Rapids, Mich.
Corrosion and abrasion resistant—ISOROD, RESISTO-LOY

Revere Copper & Brass Inc., 230 Park Ave., New York.
Non-magnetic, corrosion resistant, silicon bronze—HERCULOY
Bearing bronze—ROMAN BRONZE

Rhoades, R. W., Metaline Co., Inc., P. O. Box No. 1, Long Island City, N. Y.
Heat resisting bearing bronze—METALINE

Riverside Metal Co., Riverside, N. J.
Copper-tin-nickel-zinc alloy—RIVERSIDE

Rustless Iron & Steel Corp., 3400 E. Chase St., Baltimore.
Chromium and chromium nickel stainless steels — DEFIRUST, DEFIHEAT, DEFISTAIN, RUSTLESS 17
Hardening type stainless steel—RUSTLESS

Ryerson, Jos. T., & Son Inc., 16th and Rockwell Sts., Chicago.
Specially processed lead base alloys—GLYCO BABBITT

S

Saginaw Bearing Co., Saginaw, Mich.
Bearing bronzes—SABECO and AGRICOLA

Sandusky Foundry & Machine Co., Sandusky, O.
Nickel-chromium and molybdenum cast iron alloys—SANDUSKY ALLOY IRON
Bronze, brass and manganese bronze alloys—SANDUSKY BRONZES

Scovill Mfg. Co., Waterbury, Conn.
Copper alloys—ADNIC
Hardware bronze—SCOVILL
Spring material—OREIDE
Copper-lead-zinc alloy—SCOVILL FREE-CUTTING BRASS ROD
Copper-tin-zinc alloy — SCOVILL NAVAL BRASS

Seitzinger's, T. F., & Sons, 900 Ashby, N. W., Atlanta, Ga.
Bearing bronze—DIXOILBRONZ

Seymour Mfg. Co., Seymour, Conn.
High corrosion resisting alloys—SEYMOUR and SEYMOURITE

Shenango-Penn Mold Co., Dover, O.
High strength alloys—SHENANGO-PENN

Sivyer Steel Casting Co., 1675 S. 43rd St., Milwaukee.
Corrosion and heat resisting cast steels—SIVYER
Abrasion resisting cast steel—SIVYER
Alloy cast steels—SIVYER

Standard Alloy Co., 1679 Collamer Ave., Cleveland.
Corrosion and heat resisting alloys—STANDARD-ALLOY

Steel & Tubes Inc., Cleveland.
Copper bearing steel—ELECTRUNITE

Stoody Co., Whittier, Calif.
Wear resisting alloys—STOODITE, STOODITE (Numbered), STOODY (Self-Hardening), SILFRAM, BORIUM

Sumet Corp., 1543 Filmore Ave., Buffalo.
Bronze bearings—SUMET

Summerill Tubing Co., Bridgeport, Montgomery Co., Pa.
Seamless tubing—SUMMERILL

Superior Steel Corp., Carnegie, Pa.
Stainless strip steel—SUPERIOR STAINLESS

T

Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Corrosion and abrasion resistant alloys—TISCO
Austenitic wear resisting steel—TIMANG

Thomas Steel Co., Warren, O.
Cold rolled strip steel—THOMASTRIP

Timken Steel & Tube Div., The Timken Roller Bearing Co., Canton, O.
Abrasion resistant bearing alloys—GRAPHTUNG, GRAPH-SIL, GRAPH-MO
Creep resisting alloy steels—DM STEEL, DM-45, SICROMO STEEL
Heat resistant alloys—SILMO, TIMKEN 17-22A

Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Extra low carbon trimming steel—TAMCO

True Alloys Inc., 1820 Clay St., Detroit.
Aluminum-bronze alloys—TRUALOY

U

Union Drawn Steel Div., Republic Steel Corp., Massillon, O.
Cold drawn steels—UNION
Free-machining steels—UMA

Union Steel Casting Co., 62nd and Butler Sts., Pittsburgh.
Alloy cast steel—UNIVAN

Unitcast Corp., Steel Casting Div., Toledo, O.
Cast steels—TOLEDO ALLOY

United States Graphite Co., Saginaw, Mich.
Bearing bronze—GRAMIX

United States Steel Corp., 434 Fifth Ave., Pittsburgh.
Stainless steels, Shelby tubing, castings, and electrical steel sheets—USS
Atmospheric corrosion and abrasion resistant alloys—U.S.S. COR-TEN, and U.S.S. MAN-TEN

Universal Cyclops Steel Corp., Titusville, Pa.
Corrosion and heat resisting alloys—CYCLOPS, UNILOY
Nondeforming tool steel—CYCLOPS WANDO
Special alloy tool steel—CYCLOPS ORION

V

Victor Mfg. & Gasket Co., 5750 Roosevelt Rd., Chicago.
Laminated sheet packing—VICTOPAC
Vegetable fiber base sheet packing—VICTORITE
Asbestos sheet—VICTOR
Cork sheet—VICTOR
Mineral base asbestos—ASBESTOPRENE
Synthetic resin—VICTROPRENE

W

Waukesha Foundry Co., North Chicago, Ill.
Copper-base alloy—WAUKESHA

Wellman Bronze & Aluminum Co., 6017 Superior Ave., Cleveland.
Copper-tin-zinc-lead alloys—IDEALOY, ANFRILOY
Aluminum-silicon-titanium alloy—WELLCAST 17S

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Corrosion and heat resisting alloy—KONAL, PHOS-COPPER, K-42-B
Magnetic alloy—HIPERNIK
Gas type metal—KOVAR
Copper base alloy—CUPALOY

West Steel Casting Co., 805 E. 70th St., Cleveland.
Molybdenum-vanadium-nickel alloy—CUMLOY
High tensile strength alloy—DURACAST

Wheelock, Lovejoy & Co. Inc., 128 Sidney St., Cambridge, Mass.
Machinery steels—ECONOMO, HYTEN

Wilcox-Rich Div., Eaton Mfg. Co., 9771 French Rd., Detroit.
Corrosion and abrasion resistant alloys—WILRICH, XALOY

Williams, E. A., & Son Inc., 111 Plymouth St., Jersey City, N. J.
Babbitt metals for bearings—CLOVERLEAF, DIAMOND G BRONZE, MILL BRASS MIX
Bearing bronzes—WILLIAMS No. 50 BRONZE

Wilson, H. A., Co., Newark, N. J.
Thermostatic bimetal—THERMOMETAL, WILSON Contacting Materials

Wolverine Tube Co., 1411-1491 Central Ave., Detroit.
Tubing—WOLVERINE

Wood, Alan, Steel Co., Conshohocken, Pa.
High strength steel—"AW" DYN-EL
Rolled steel floor plate—"AW"

Y

Youngstown Alloy Casting Corp., Youngstown, O.
High tensile strength—TRANTINYL

Youngstown Sheet & Tube Co., Youngstown, O.
High strength alloy steel—YOLOY

Section II—Plastics and other Nonmetallics

Aetna Rubber Co., E. 79th St., Cleveland.
Hard rubber—AETNA

American Cyanamid Co., Beetleware Div., 30 Rockefeller Plaza, New York.
Urea formaldehyde plastic—BEETLE

American Felt Co., 315 Fourth Ave., New York.
Felt material—"K" FELT

American Hard Rubber Co., 11 Mercer St., New York.
Hard rubber—ACE

American Phenolic Corp., 1250 W. Van Buren St., Chicago.
Phenolic plastic—AMPHENOL

American Plastics Corp., 50 Union Sq., New York.

Casein plastic—AMEROID

Armstrong Cork Products Co., Lancaster, Pa.
Cork and synthetic rubber compound—CORPRENE
Resilient board of cork granules—VI-BRA-CORK

Atlas Powder Co., Zapan Div., Stamford, Conn.
Cloth base and Bakelite resinous plastic—REVOLITE

Bakelite Corp., 247 Park Ave., New York.
Phenolic plastics—BAKELITE

Booth Felt Co., 444—19th St., Brooklyn, N. Y.
Wool base felt—BOOTH FELT

Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Material for impregnated wood bushings, etc.—NIGRUM

Brandywine Fibre Product Co., 1404 Walnut St., Wilmington, Del.
Chemically-treated paper — BRANDYWINE FIBRE

Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York.
Resinous plastic—VINYLITE

Catalin Corp., 1 Park Ave., New York.
Phenolic plastics—CATALIN, PRYSTAL

Celluloid Corp., 290 Ferry St., Newark, N. J.
Cellulose acetate plastic—LUMARITH
Cellulose nitrate plastic—CELLULOID
Cellulose acetate thermoplastic—LUMARITH PROTECTOID

Chicago Rawhide Mfg. Co., 1301 Elston Ave., Chicago.
Synthetic rubber compounds—SIRVENE
Heat resisting leather—SIRVIS

Colasta Co. Inc., Div. of Specialty Insulation Mfg. Co. Inc., Hoosick Falls, N. Y.
Resinous material compounded with rubber—COLASTA No. 56

Colt's Patent Fire Arms Mfg. Co., 17 Van Dyke Ave., Hartford, Conn.
Hard rubber and asbestos base material—VULCABESTON

Continental Diamond Fibre Co., Newark, Del.
Phenolic plastic—DILECTO, DIAMOND
Resinous plastic—VULCOID, CELLANITE, CELORON
Vulcanized fibre—CODITE
Fibrous, flexible material—MICABOND

Corning Glass Works, Corning, N. Y.
Ceramic base glass—PYREX GLASS

Cutler-Hammer Inc., 12th and St. Paul, Milwaukee
Bituminous plastic—THERMOPLAX
Asbestos base material—PYROPLAX

Dow Chemical Co., Midland, Mich.
Plastic granules—ETHOCEL
Cellulose ether base, thermoplastic—ETHOFOIL
Thermoplastic—STYRON
Fiberous thermoplastic—VB-114

Du Pont de Nemours, E. I., & Co. Inc., Wilmington, Del.
Chloroprene rubber—NEOPRENE
Plastic coated wire mesh—CEL-O-GLASS
Nitrocellulose base—PYRALIN
Polymethyl-methacrylate base—LUCITE
Cellulose acetate base—PLASTACELE

Durez Plastics & Chemicals Inc., North Tonawanda, N. Y.
Phenolic plastic—DUREZ

Durite Plastics, Div. of Stokes & Smith Co., 5010 Summerdale Ave., Philadelphia.
Phenol-furfural plastic—DURITE

Farley & Loetscher Mfg. Co., Dubuque, Iowa.
Phenolic and urea plastic—FARLITE
Fibrous core with laminated Bakelite surface—FARLITE LOETEX

Felters Co. Inc., 210 South St., Boston.
Laminated felt—DUFFELT
Felt for vibration isolation, etc.—UNISORB
Felt for grease & oil retention—FELTERS CERTIFIED FELT

Formica Insulation Co., 4613 Springs Grove Ave., Cincinnati, O.
Laminated resinous plastic—FORMICA

Franklin Fibre-Lamitex Corp., 190 E. Twelfth St., Wilmington, Del.
Phenolic base, thermosetting material—LAMITEX

Garfield Mfg. Co., Garfield, N. J.
Thermosetting materials—GUMMON (black); HEMIT (gray-white); TEGIT (brown or black)

Gemloid Corp., 7910 Albion Ave., Elmhurst, L. I., N. Y.
Thermoplastic material—GEMLOID (Enameloid Cloisonnette)

General Electric Co., 1 Plastics Ave., Pittsfield, Mass.
Nonrefractory and refractory materials—TEXTOLITE: Two types

Goodrich, B. F., Co., Akron, O.
Synthetic rubber—KOROSEAL

Haskelite Mfg. Corp., 208 Washington St., Chicago.
Waterproof plywood — HASKELITE, PLYMETAL

Haveg Corp., Newark, Del.
Phenolic plastic—HAVEG
Phenol formaldehyde plastic—HAVEGIT

Heresite & Chemical Co., Manitowoc, Wis.
Phenolic resin—HERESITE

Inceloid Co. Inc., 410 Camp St., New Orleans, La.
Cellulose derivative—INCELOID

Johns-Manville, 22 E. 40th St., New York.
Diatomaceous silica material—CELITE
Rubbery, asphaltic-asbestos material—AERTITE
Asbestos, fiber, graphite and rubber compound—EEL-SLIP
Weatherproof coating—INSULKOTE
Fireproof material—TRANSITE

Keasbey & Mattison Co., Ambler, Pa.
Asbestos materials—HY-TEMP, KEASBEY ASBESTOS

Knight, Maurice A., Kelly Ave., Akron, O.
Depolymerized colloidal resin plastic—PYROFLEX
Corrosion resistant stoneware — KNIGHTWARE

Korfund Co. Inc., 58-15—32nd Place, Long Island City, N. Y.
Finely granulated compressed cork plates—KOMPO-KORK
Resilient mat of pure natural cork—KORFUND
Finely granulated cork and rubber—KORK-RUBBER
Permanent elastic cork material—VIBRO-PLATE

Luzerne Rubber Co., Dewey St., Trenton, N. J.
Hard rubber, thermoplastic—LUZERNE HARD RUBBER

Makalot Corp., 262 Washington St., Boston.
Synthetic resin plastic—MAKALOT

Marblette Corp., 3721 30th St., Long Island City, N. Y.
Phenolic plastic—MARBLETTE

Meissner Mfg. Co., 2815 W. Nineteenth St., Chicago.
Phenolic base, thermoplastic—MEISSNER

Mica Insulator Co., 200 Varick St., New York.
Phenolic plastic—LAMICOID
Varnished cambric cloth—EMPIRE
High resistant and high dielectric—MICANITE

Monsanto Chemical Co., Plastics Div., Springfield, Mass.
Cellulose nitrate plastic—MONSANTO Cellulose Nitrate
Phenolic plastic—MONSANTO Cast Phenolic, MONSANTO RESINOX
Polyvinyl acetal plastic—MONSANTO BUTVAR, FORMVAR

National Carbon Co. Inc., Madison Ave. & W. 117th St., Cleveland.
Carbon or graphite in amorphous or graphitic form—NATIONAL CARBON

National Vulcanized Fibre Co., Wilmington, Del.
Laminated Bakelite—PHENOLITE
Cotton cellulose base, vulcanized fiber—NATIONAL FIBRE, NATIONAL SWITCH INSULATION
Cotton rag base, fish paper insulation—PEERLESS

Owens-Corning Fiberglas Corp., Toledo, O.
Glass, in fibrous form—FIBERGLAS

Panelyte Corp., 230 Park Ave., New York.
Synthetic laminated resinous material—PANELYTE

Penn Fibre & Specialty Co., 912 S. Front St., Philadelphia.
Phenol and vulcanized fiber—PENN

Plaskon Co. Inc., 2112 Sylvan Ave., Toledo, O.
Urea formaldehyde plastic — PLASKON, UNYTE

Polaroid Corp., 285 Columbus Ave., Boston.
Light-polarizing glass—POLAROID

Reilly Tar & Chemical Corp., Merchants Bank Bldg., Indianapolis.
Phenolic plastic—INDUR, INDUR VARNISH

Resinous Products & Chemical Co. Inc., 222 W. Washington Sq., Philadelphia.
Phenolic resin and thin wood veneer—TEGOWOOD

Resistoflex Corp., 370 Lexington Ave., New York.
Polyvinyl alcohol plastic—RESISTOFLEX PVA

Richardson Co., The, Melrose Park, Ill.
Thermosetting plastic—INSUROK
Hard rubber—RUB-TEX, RUB-EROK
Acid-resisting bituminous plastic—EBROK

Robertson, H. H., Co., Grant Bldg., Pittsburgh, Pa.
Felt bonded to metal—ROBERTSON FELT-BONDED METAL

Rohm & Haas Co. Inc., 222 W. Washington Sq., Philadelphia.
Acrylic base plastic—PLEXIGLAS, CRYSTALLITE

Ryerson & Son Inc., Jos. T., 16th and Rockwell Sts., Chicago
Bearing material—RYERTEX

Self-Vulcanizing Rubber Co. Inc., 605 W. Washington Blvd., Chicago.
Gum rubber base material, in liquid form—AIRVULC
Cold curing gum rubber, liquid form—SELFVULC

Siemon Co., Bridgeport, Conn.
Shellac base plastic—HARVITE

Stokes & Smith Co. (Durite Plastics Div.) Philadelphia.
Phenol furfural plastic—DURITE

Surprevant Electrical Insulation Co., 84 Purchase St., Boston.
Insulating tubing—SURCO-SOLFLEX TUBING

Spaulding Fibre Co. Inc., Tonawanda, N. Y.
Fibrous material — SPAULDING FIBRE, SPAULDING ARMITE, SPAULDO
Phenolic plastic—SPAULDITE

Synthane Corp., Oaks, Pa.
Laminated Bakelite—SYNTHANE

Taylor Fibre Co., Norristown, Pa.
Phenolic base thermosetting material—TAYLOR FIBRE

Tennessee Eastman Corp., Kingsport, Tenn.
Cellulose acetate plastic—TENITE

Thiokol Corp., Trenton, N. J.
Synthetic rubber—THIOKOL

United States Stoneware Co., Akron, O.
Ceramic base, nonplastic—VITRIC-10
Resinous thermoplastics—RESILON, TYGON

Watertown Mfg. Co., Watertown, Conn.
Phenolic plastic—NEILLITE

Western Felt Works, 4117 Ogden St., Chicago.
Felt material—WESTFELT, CASKOFELT

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Phenolic plastic—MICARTA

Wilmington Fibre Specialty Co., Wilmington, Del.
Paper base material—FYBEROID
Cotton rag and paper, nonplastic—WILMINGTON FIBRE
Phenolic plastic—OHMOID

Stampings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of stampings; (b) Names of stamped machine parts customarily produced; and (c) Machining, heat treating or assembling facilities.

A

Ace Hardware Mfg. Corp., The George Jones Co., 2020 E. Orleans St., Philadelphia.
(a) Flat, drawn and formed stampings of all materials, 5-75 tons pressure capacity. Sizes 20 in. square light and heavy gages.
(b) To customers' specifications.
(c) Complete facilities.

Accurate Spring Mfg. Co., 3811 W. Lake St., Chicago.
(a) Blanking, forming and perforating all metals, small and medium sizes, specializing in spring materials.
(b) To customers' specifications.
(c) Complete facilities.

Acklin Stamping Co., 1925 Nebraska Ave., Toledo, O.
(a) Pressed metal parts of steel, brass and aluminum to 40 in. dia., .010 to ⅝ in. metal thickness.
(b) To customers' specifications.
(c) Complete facilities.

Adams Metalware Co., S. G., 2947 Delmar Blvd., St. Louis.
(a) Medium deep drawn, large blanked and formed stampings in brass, copper, steel, aluminum, Monel, stainless steel; to 6 in. deep drawn and 30 x 60 blanked and formed.
(b) Vending machines, ice cream cabinets, air conditioning equipment, stokers and automotive parts.
(c) Complete finishing facilities.

Akron Metallic Gasket Co., 162 N. Union St., Akron, O.
(a) Small light metal stampings.
(b) Gaskets, washers, and shims.
(c) Machining facilities.

Akron Selle Co., High St., Akron, O.
(a) Hot-rolled pickled and cold-rolled steel, stainless steel, brass and decorated metal stampings, from .015-3/16 in. and from ½ in. dia.—18 in. x 38 in., drawing to 3 in. deep.
(b) Stove, washing machine, automotive and refrigerator parts.
(c) Assembling, welding and riveting.

Aluminum Goods Mfg. Co., Washington St., Manitowoc, Wis.
(a) Aluminum stampings, spinnings and deep drawings.
(b) Refrigerator, radio, textile, electrical, and automotive parts.
(c) Complete facilities.

American Aluminum Ware Co., 368-378 Jelliff Ave., Newark, N. J.
(a) Aluminum industrial stampings and spinnings.
(b) Pouring spouts, spools, reflectors, boxes, tubes, etc.
(c) None.

American Emblem Co. Inc., Box D 116, Utica, N. Y.
(a) Art metal and intricate stampings up to 16 in. square; .003 to .25-in. metal thickness.
(b) Embossed nameplates, radio escutcheons and dials and ornamental stampings.
(c) Complete facilities.

American Pulley Co., 4200 Wissahickon Ave., Philadelphia.
(a) Pressed steel stampings in light to heavy steel gages; also deep drawn stampings.
(b) To customers' specifications.
(c) Complete facilities.

Amesbury Metal Products Co., Inc., 39 Oakland St., Amesbury, Mass.
(a) Stampings from deep drawn and cold rolled steel, brass, aluminum, nicral and copper.
(b) Automobile and marine lamp equipment, clock cases, vending machine cabinets and mechanisms.
(c) Complete facilities.

Apco Mossberg Co., Attleboro, Mass.
(a) Medium and heavy stampings from .05-.187 in. thick.
(b) To customers' specifications.
(c) Complete facilities.

Arkansas Machine Specialty Co., Hope, Ark.
(a) Metal stampings light enough for presses to 50 tons capacity.
(b) To customers' specifications.
(c) Complete facilities.

Auto Sun Products Co., The, 529 Poplar St., Cincinnati.
(a) Small and medium stampings to 5 in. draw, from steel, brass, bronze and aluminum, up to 5/16 in. thick, 16 x 24 in.
(b) Radio, refrigerator, wash machine parts, etc.
(c) Assembling facilities.

B

Barnes-Gibson-Raymond Div., Associated Spring Corp., 6391 Miller Ave., Detroit. (The Cook Plant—Ferry Field and Boulevard drive, Ann Arbor, Mich.)
(a) Small flat springs and stampings from carbon and alloy steels and nonferrous metals.
(b) Special small stampings, formed flat wire parts, catches, clips, contacts, snap rings, retainers and washers.
(c) Complete facilities.

Barth Stamping & Machine Works, 3815 W. 34th St., Cleveland.
(a) Light and medium stampings of steel, brass, aluminum, etc.
(b) To customers' specifications.
(c) Machining facilities.

Bellevue Mfg. Co., The, Bellevue, O.
(a) Deep drawn to 12 in., and general small stampings.
(b) Automotive.
(c) Annealing, enameling, plating and assembling.

Bossert Co. Inc., The, 1002 Oswego St., Utica, N. Y.
(a) Stampings from .005 to 1 in. in thickness, any metal.
(b) Automotive, refrigeration, washing machine, radio, etc.
(c) Assembling and welding facilities.

Bowen Products Corp., 4647 Fourth St., Ecorse, Mich. (also Auburn, N. Y.)
(a) Heavy, medium and light stampings, 6 in. max. draw, 8 in. max. dia.
(b) Shells, bushings, sockets and lubricating devices.
(c) Complete facilities.

Bridgeport Brass Co., 774 East Main St., Bridgeport, Conn.
(a) Brass, bronze and copper shells drawn to 6 in. dia., 36 in. long; blanked and formed shells.
(b) To customers' specifications.
(c) Polishing, plating and assembling facilities.

Briskin Mfg. Co., 4243 West Ogden Ave., Chicago.
(a) Light, heavy and extra deep draw stampings of steel, stainless steel and brass.
(b) To customers' specifications.
(c) Tool room equipment.

Bridgeport Chain & Mfg. Co., The, Bridgeport, Conn.
(a) Small flat stampings of steel, brass and bronze, to .065 in. gage, 4 in. length or dia.
(b) To customers' specifications.
(c) Complete facilities.

Budd, Edward G., Mfg. Co., Philadelphia. (Detroit branch located at 13141 Charlevoix Ave.)
(a) Automobile body and small special stainless stampings of mild steel.
(b) Automotive, chemical and rayon, rail cars, commercial trailers, marine and aircraft fields.
(c) Complete facilities.

Buffalo Brake Beam Co., 140 Cedar St., New York.
(a) Small stampings from light bars and strip stock.
(b) To customers' specifications.
(c) Information not available.

Burgess-Norton Mfg. Co., Geneva, Ill.
(a) Steel stampings, flat, drawn or formed on presses of 125-ton capacity and smaller.
(b) Automotive parts.
(c) Complete facilities.

C

Chapin, The R. E., Mfg. Works Inc., 29 Liberty St., Batavia, N. Y.
(a) Blanks to 26-in. dia. light gage.
(b) Sprayers, atomizers, pumps.
(c) Machining.

Chase Brass & Copper Co. Inc., 236 Grand St., Waterbury, Conn.
(a) All type sheet metal stampings, drawn shells of brass, copper and copper alloys.
(b) All types of parts.
(c) Machining, polishing, plating and assembling facilities.

City Auto Stamping Co., Lint and Dura Ave., Toledo, O.
(a) Large light-gage stampings.
(b) Automotive.
(c) Assembling facilities.

Clegg Mfg. Co., 19 Summer St., Attleboro, Mass.
(a) Sheet metal stampings to 10 in. dia., or 8 x 14 in., from brass, copper and sheet iron.
(b) Radio parts, etc.
(c) Machining and assembling facilities.

Cleveland Pressed Steel Co., 2593 E. 55th St., Cleveland.
(a) Small and medium stampings from any material.
(b) Variety of parts.
(c) Adequate facilities.

Cleveland Steel Products Corp., Plant No. 2, Wellington, O.
(a) All types to 12 in. draw, 12 in. dia., ¼ in. thick.
(b) Automotive, radio, industrial and electrical.
(c) Complete secondary operation, cyanide hardening, plating and assembling.

Clum Mfg. Co., 601 West National Ave., Milwaukee.
(a) Precision stampings from steel, brass, stainless steel and aluminum, in thicknesses

...01-.125, 10 x 16 in.
(b) Electric switches, etc.
(c) Tool room equipment and assembling.

Cogswell Mfg. Co. Inc., 140 Norman St., West Springfield, Mass.
(a) Cold-rolled steel, stainless steel, brass and aluminum stampings.
(b) Electric switch parts, etc.
(c) Well equipped for spot welding and plating.

Columbia Metal Stamping Co., The, 11900 Harvard Ave., Cleveland.
(a) Light and medium stampings in all metals to ¼ in. thick, to 24 x 24 in. Deep drawn to 3½ in. deep, ⅛ thick.
(b) Automotive, electrical, industrial and general.
(c) Complete facilities.

Commercial Shearing & Stamping Co., 1775 Logan St., Youngstown, O.
(a) To 60 in., ¾-in. gage, steel and copper alloys, aluminum and stainless steel.
(b) Tank heads and other heater parts.
(c) Machining and assembling facilities.

Cuyahoga Spring Co., The, 10252 Berea Rd., Cleveland.
(a) Stampings of cold-rolled steel, up to No. 10 gage; flat springs stamped or formed and tempered for mechanical purposes; also brass, bronze stampings.
(b) Primarily flat springs.
(c) Complete facilities.

D

Dahlstrom Metallic Door Co., Buffalo St., Jamestown, N. Y.
(a) Steel (stainless), brass, bronze, aluminum stampings and drawn parts. Press equipment Bliss 3-B to 7-E, and brake presses for sections 10 to 12 ft. long.
(b) Machine guards, cabinets, latches, brackets and special parts.
(c) Complete assembling facilities.

Dayton Rogers Mfg. Co., 2830 S. 13th Ave., Minneapolis.
(a) Stampings of steel, brass, copper, aluminum, Bakelite, and all sheet stock; 24 x 24 in., max. thickness ¼ in.
(b) Adding machines, office equipment, aircraft and various small parts.
(c) Machining and heat treating.

Defiance Pressed Steel Co., Otis and Cheney Sts., Marion, O.
(a) Small and medium sized stampings.
(b) Automobile parts, heaters and steering wheels.
(c) Complete assembling facilities.

Dellinger Mfg. Co., 725 N. Prince St., Lancaster, Pa.
(a) Small and medium metal stampings of brass, steel and aluminum.
(b) Radio, electrical, farm machinery parts, etc.

Diamond Expansion Bolt Co., Inc., Garwood, N. J.
(a) Blanking, piercing and bending, strip steel, brass, copper and aluminum; from small to capacity of 70-ton press.
(b) Cable straps, toggle bolts, nuts, hammer drive anchors, etc.
(c) Complete facilities.

Dill Mfg. Co., The, 700 E. 82nd St., Cleveland.
(a) Small brass and steel stampings.
(b) Ferrules, rubber inserts, valves and valve parts, etc.
(c) None.

Dominion Electrical Mfg. Inc., 22 Elm St., Mansfield, O.
(a) Small and medium light-gage steel stampings.
(b) Household appliances.
(c) Drill press, complete plating and assembling.

Douglas & Lomason Co., 5836 Lincoln Ave., Detroit.
(a) Formed-draws up to 300-ton presses of C. R. steel, stainless steel, brass and aluminum, to 18 x 36 in.
(b) Radiator grilles, extension panels, nameplates, instrument board plates, etc.
(c) Machining and assembling facilities.

Duplex Mfg. Corp., Sherman, N. Y.
(a) All type stampings of steel or galvanized sheets, small and large.
(b) Brackets, braces, airplane parts and other small parts.
(c) Complete facilities.

E

Eaton Mfg. Co., Stamping Division, Cleveland.
(a) Steel and brass stampings, to 18 in. dia.
(b) All types of stampings.
(c) Annealing, brazing and welding facilities.

Ellis, George D., & Sons Inc., 309 N. 3rd St., Philadelphia.
(a) Tinplate, steel, copper, aluminum and brass stampings, lighter than 20 gage.
(b) Knitting and weaving machine, vending machine, radio and electrical device parts.
(c) Machining and assembling facilities.

Ennen, Geo. L., Co., 7 Emerick St., Ypsilanti, Mich.
(a) Small steel stampings.
(b) Automotive.
(c) None.

Erie Art Metal Co., 18th and Schaal Ave., Erie, Pa.
(a) All type fabricated sheet metal parts, ferrous and nonferrous.
(b) Vault boxes, refrigerator cabinets, steel stove parts, etc.
(c) Complete facilities.

ESMCO Auto Products Corp., 33 34th St., Brooklyn.
(a) Blanking, forming and drawing, light and heavy, as well as intricate stampings of steel to 24 in. sq.
(b) Clutch disks, etc.
(c) Complete facilities.

Eureka Tool & Machine Co., 27 W. 55th St., New York.
(a) Small and medium stampings.
(b) To customers' specifications.
(c) Complete facilities.

F, G

Falstrom Co., Main Ave., Passaic, N. J.
(a) Shallow stampings of steel, aluminum, copper, etc., press brake 3/16 in. x 10 ft. long, punch press 14 in. gage.
(b) Machine enclosures, guards, cabinets, instrument panels, etc.
(c) Machining and assembling facilities.

Firestone Steel Products Co., Akron, O.
(a) Blanking, forming and drawing metal stampings, hot and cold-rolled steel, stainless steel; in small or large sizes.
(b) Automotive and general machine parts.
(c) Information not available.

Fitzsimmons Mfg. Co., 3104 E. Woodbridge St., Detroit.
(a) Small and medium stampings of steel, brass and copper.
(b) Automotive, refrigerator and general parts.
(c) Complete facilities.

Fox Co., Fox Bldg., Cincinnati.
(a) Any size, shape of metal stampings.
(b) Nameplates, hub caps, etc.
(c) Assembly facilities.

Geometric Stamping Co., The, 1111 E. 200th St., Cleveland.
(a) Any type stampings in steel, stainless steel, brass, etc., ½ in. thick, 48 x 84 in.
(b) Dairy, washing machine, radio, railroad and automobile parts, etc.
(c) Complete facilities.

Gerding Bros., 3rd and Vine Sts., Cincinnati.
(a) Light stampings, forming, and shallow draw, of galvanized iron, cold-rolled steel, brass, copper and stainless steel, to 30 in. sq. and ¼ in. thick.
(b) Vending machine and special machine parts.
(c) Machining and welding facilities.

Geuder, Paeschke & Frey Co., 324 N. 15th St., Milwaukee.
(a) Deep drawn in all metals to 48 in. dia., 18 in. deep, 12-30 gage.
(b) Business and vending machine cases, tubs for electric washers, switch and transformer cases.
(c) Complete facilities.

Gibson Co., William D., Div. of Associated Spring Corp., 1800 Clybourn Ave., Chicago.
(a) Miscellaneous stampings of cold-rolled spring steel, stainless and alloys, small and medium.
(b) Springs.
(c) Heat treating facilities.

Globe Machine & Stamping Co., 1250 W. 76th St., Cleveland.
(a) Metal stampings of all sizes.
(b) Various types of parts.
(c) Machining and assembling facilities.

Goat, Fred, Co. Inc., The, 314 Dean St., Brooklyn.
(a) Stamped, formed, drawn light sheet metal, steel, stainless steel, nickel, silver, tantalum, Monel, molybdenum, brass, copper, tin plate and zinc; .001 to ⅛ in., 1 to 10,000 per lb.
(b) Special cups, clips, caps, eyelets, etc.
(c) Complete facilities.

Grammes, L. F., & Sons Inc., Allentown, Pa.
(a) Stampings of brass, aluminum, steel, etc.
(b) Automotive, radio, clock and electrical.
(c) Complete facilities.

Gray, Peter, Corp., 290 Third St., Cambridge, Mass.
(a) Steel and nonferrous metals, drawn, stamped and formed, up to 3/16 in. thick x 5 sq. ft. on press work and 8 ft. long on brake work.
(b) Handles, guards, stop motions, meters, fans, covers, radio and textile machine parts.
(c) Complete assembling and some machining facilities.

Greer, Frederic, Co., 2630 West Flournoy St., Chicago.
(a) Small automatic stampings in any material.
(b) Terminals of all types.
(c) Complete facilities.

Gregory Mfg. Co., 2964 Whitney Ave., Mt. Carmel, Conn.
(a) Steel, brass, copper, etc., in shapes fitting within 12 in. circle.
(b) Switches, spring tension washers and various other stampings.
(c) Complete facilities.

Greist Mfg. Co., The, New Haven, Conn.
(a) Small stampings, specializing on forming operations.
(b) Business machine, photographic, electrical, sewing machine parts and assemblies.
(c) Complete facilities.
See advertisement, Page 55-D

Griffith-Hope Co., 6607 W. Mitchell St., West Allis, Wis.
(a) Stampings of 30 gage to 10 gage drawn shapes, and shells up to 5 in. in depth.
(b) Paper-dispensing equipment, automobile stampings, etc.
(c) Assembling facilities.

Guth Co., The Edwin F., 2615 Washington Blvd., St. Louis.
(a) Punched and deep drawn stampings of steel, bronze, and brass up to 24 in. dia.
(b) To customers' specifications.
(c) Complete facilities.

H

H. K. Metal Craft Mfg. Corp., 390 Second Ave., New York.
(a) Blanking, piercing, forming, hollow drawing, medium and light gages, of all metals.
(b) To customers' specifications.
(c) Riveting, eyeleting and spotwelding.

Hagstrom Mfg. Co., 505 W. 25th St., Kansas City, Mo.
(a) Small stampings to 24 in. square, in all metals.
(b) Vending machine, etc.
(c) Machining facilities

Hardy Mfg. Corp., Corner of Broadway and Water St., Pendleton, Ind.
(a) All stampings, including deep drawing. No. 1 presses to toggle presses of 300-ton capacity.
(b) Radio cabinets, radio parts, automobile parts and general stampings.
(c) Complete facilities.

Harvey Machine Co., 6200 Avalon Blvd., Los Angeles.
(a) All kinds of blanking, deep drawing up to 42 x 62 in. bed, in all metals.
(b) All types of machine parts.
(c) Complete facilities.

Hoosier Lamp & Stamping Corp., Evansville, Ind.
(a) Light gage, aluminum, stainless, Monel, brass, etc.
(b) Interior refrigerator parts, etc.
(c) Alumiliting, plating, welding and complete assembling.

Hubbard, M. D., Spring Co., Pontiac, Mich.
(a) Small stampings in spring steels, hot and cold-rolled steel, brass, bronze, aluminum,

Monel and stainless steel.
(b) Expansion plugs, washers, flat springs and spring washers.
(c) Drilling, tapping, spot welding, and heat treating.

Hunter Pressed Steel Co., Lansdale, Pa.
(a) Various types, including deep drawn stampings, from smallest to ⅛-in. stock, 15 in. blank in all materials.
(b) All types of machine parts.
(c) Complete facilities.

I

Indiana Pressed Steel Co., Muncie, Ind.
(a) Medium and medium-large stampings in all metals.
(b) Refrigerator, automotive, radio, electrical, etc.
(c) Complete facilities.

J

Johnson Sheet Metal Works Corp., Richmond, Ind.
(a) Metal stampings to 1050-ton capacity.
(b) Truck and tractor parts, bus bodies, etc.
(c) Assembling facilities only.

Joslin Mfg. Co., A. D., Manistee, Mich.
(a) Blanking, perforating, forming, drawing, of steel, brass, copper, stainless steel, aluminum, etc., to 6 in. dia.
(b) Electric toaster and clock parts, etc.
(c) Complete facilities.

K

Karp Metal Products Co. Inc., 129 30th St., Brooklyn, N. Y.
(a) Steel, brass, aluminum, Monel, stainless steel, and other alloy stampings.
(b) Air conditioning, vending machines and storage cabinets, cases and boxes for electrical and mechanical devices.
(c) Welding facilities.

Kees, F. D., Mfg. Co., 24 High St., Beatrice, Nebr.
(a) Light and medium stamped and formed parts and shallow drawings.
(b) All types of machine parts.
(c) Complete facilities.

Kickhaefer Mfg. Co., 901 S. Second St., Milwaukee.
(a) Small and medium stampings of steel, brass, copper and aluminum.
(b) Valve spring washers, special washers, tubing, engine front and rear plates, plugs, etc.
(c) None.

Klein Mfg. Co., Burlington, Ia.
(a) Steel and galvanized iron stampings.
(b) To customers' specifications.
(c) Complete facilities.

Konigslow, Otto, The, Mfg. Co., 3610 Perkins Ave., Cleveland.
(a) Small and medium-sized stampings in any metal.
(b) Spacing washers, stamped collars, brackets and other parts.
(c) Milling, drilling, spot welding and assembling facilities.

L

Laminated Shim Co. Inc., 21-26 44th Ave., Long Island City, N. Y.
(a) Small, flat, brass, steel, zinc, copper, etc.
(b) Shims.
(c) None.

Larson Tool & Stamping Co., Attleboro, Mass.
(a) Blanking, forming, drawing, etc. of ferrous and nonferrous metals, to 24 x 24 in.
(b) To customers' specifications.
(c) Complete facilities.

Leake Stamping Co., 3180 Bellevue Rd., Toledo, O.
(a) Small and medium stampings.
(b) Automotive, tractor and wash machine stampings.
(c) Heat treating and assembling facilities.

Lees, John, Div., The Serrick Corp., Muncie, Ind.
(a) Small stampings in stainless steel, bronze, and cold-rolled steel.
(b) Various types of machine parts.
(c) Complete facilities.

Lewyt Metal Products Co., 112 Lafayette St., New York.
(a) Sheet metal stamping.
(b) Boxes, housings and cabinets.
(c) Machining and assembling facilities.

Liberty Electric Co., 1915 Madison Ave., Indianapolis.
(a) Stamping, drawing, spinning, of steel, aluminum, copper, brass and other alloys; size depending on gages, up to 12 x 20 in.
(b) To customers' specifications.
(c) Machining and assembling facilities.

Lidseen Inc., Gustave, 832 South Central Ave., Chicago.
(a) Blanked, drawn and formed stampings of stainless steel, Monel, mild steel, aluminum, brass, copper, etc., from ¾ in. to 300-ton press with 40 x 60 platen area.
(b) Washing and ironing machines, automotive parts, etc.
(c) Complete facilities.

Logan Co., Franklin and Buchanan Sts., Louisville, Ky.
(a) Blanking, forming, drawing, perforating, of steel, brass and aluminum, to 18 x 20 in.
(b) Bearing parts, housings, etc.
(c) Complete facilities.

Lorentzen Inc., H. K., 391 West Broadway, New York.
(a) Small and medium stampings, .01-.093 in. thickness, in nonferrous and ferrous metals.
(b) Radio parts, chassis, etc.
(c) Welding, riveting and assembling facilities.

M

Massachusetts Machine Shop Inc., 817 Albany St. Boston.
(a) Stampings of ferrous and nonferrous metals, 3/16 in. thick x 6 in. dia., or ¼ in. thick x 4 in. dia.
(b) Special size flat washers, gear blanks, etc.
(c) None.

Metal Stamping & Mfg. Co., The, 16816 Waterloo Rd., Cleveland.
(a) All gages up to ¼ in., deep drawn stampings up to 6 in. deep, in steel and other metals.
(b) All types of machine parts.
(c) Complete assembling, spotwelding, riveting, machining and japanning facilities.

Midland Steel Products Co., The, West 106th and Madison Ave., Cleveland. (Detroit branch located at 6660 Mt. Elliott).
(a) Light and heavy stampings.
(b) Automobile frames, axle housings, tubes, etc.
(c) Complete facilities.

Milwaukee Stamping Co., 800 S. 72nd St., Milwaukee.
(a) Steel, brass, bronze, etc., in thickness of ¼ in., max. draw 4 in., and up to 100-ton capacity.
(b) Belt guards, pulley flanges, legs, and special stampings.
(c) Complete facilities.

Motors Metals Mfg. Co., 5936 Milford Ave., Detroit.
(a) Large and small stampings.
(b) Automotive and refrigerator.
(c) Machining and assembling facilities.

Mullins Mfg. Corp., Warren, O. (Another plant at Salem, O.)
(a) Light and heavy gage stampings, light gage deep drawn stampings from 20 to 16 gage in sizes up to 80 x 160, depth of draw up to 22 in.
(b) Washing machine tubs, steel evaporators, and automobile parts.
(c) None.

Murray Corp. of America, 7700 Russell St., Detroit.
(a) Light and heavy stampings of any type.
(b) Fenders, hoods, grilles and bodies.
(c) None.

N

Nagel-Chase Mfg. Co., The, 2811-23 N. Ashland St., Chicago.
(a) Pressed steel parts to 11 gage and about 20 in. dia.
(b) Pulleys for V-belts, washing machine casters, etc.
(c) Complete facilities.

National Formetal Co., The, 6539 Metta Ave., Cleveland.
(a) Small stampings of steel, brass and copper.
(b) Spacer tubes, bushings, etc.
(c) Machining facilities.

New England Pressed Steel Co., Washington Ave., Natick, Mass.
(a) Stampings of steel, brass, copper, stainless steel and aluminum, small and medium.
(b) To customers' specifications.
(c) Heat treating and assembling facilities.

Niles Steel Products Div., Republic Steel Corp., Niles, O.
(a) Pressed steel to ½ in. thick.
(b) Automotive, tractor, sweeper, washing machine, etc.
(c) Some machining and assembling facilities.

Noera Mfg. Co., Div. of Chase Brass & Copper Co. Inc., Waterbury, Conn.
(a) Medium and light stampings of copper, brass, aluminum, steel, 14 in. and smaller.
(b) Washers, etc.
(c) Assembling facilities.

Nordendale Mfg. Co., 2100 Fulton St., Chicago.
(a) Blanking, forming and drawing of steel, brass, aluminum, etc., on presses from 10-75 tons.
(b) To customers' specifications.
(c) Assembling facilities.

O

O. K. Machine Co. Inc., Fairfield and Poplar Aves., Fort Wayne, Ind.
(a) Stampings from smallest sizes to not exceeding 24 in. overall and not over 6 in. deep, of steel, brass, copper and aluminum.
(b) Laminations, cups, automatic photograph and radio, liquid dispensing pump parts, etc.
(c) Complete facilities.

O'Hara Waltham Mfg. Co., 74 Rumford Ave., Waltham, Mass.
(a) Brass, copper and steel stampings in sizes to 3 x 3 in.
(b) Dials.
(c) Porcelain enameling, spot welding, etc.

P

Parish Pressed Steel Co., Reading, Pa.
(a) Heavy steel stampings of any size.
(b) Electric hoist and stoker housings, etc.
(c) Complete facilities.

Parker Wire Goods Co., 149 Washington St., Worcester, Mass.
(a) Small stampings, in materials not to exceed .11 in. diameter or square 10 in. max.
(b) To customers' specifications.
(c) Heat treating and assembling facilities.

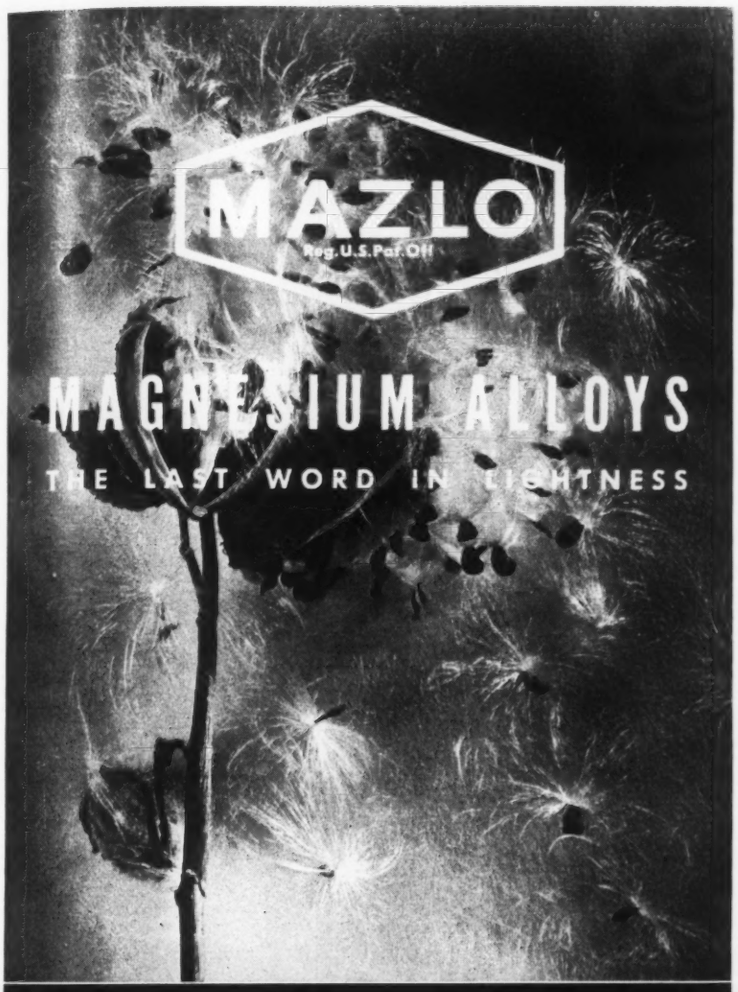
Patton-MacGuyer Co., 17 Virginia Ave., Providence, R. I.
(a) Small steel, brass, copper, bronze, and aluminum alloy stampings, blanks not larger than 20 sq. in. in area.
(b) For radios, electrical devices, etc.
(c) Limited assembling facilities.

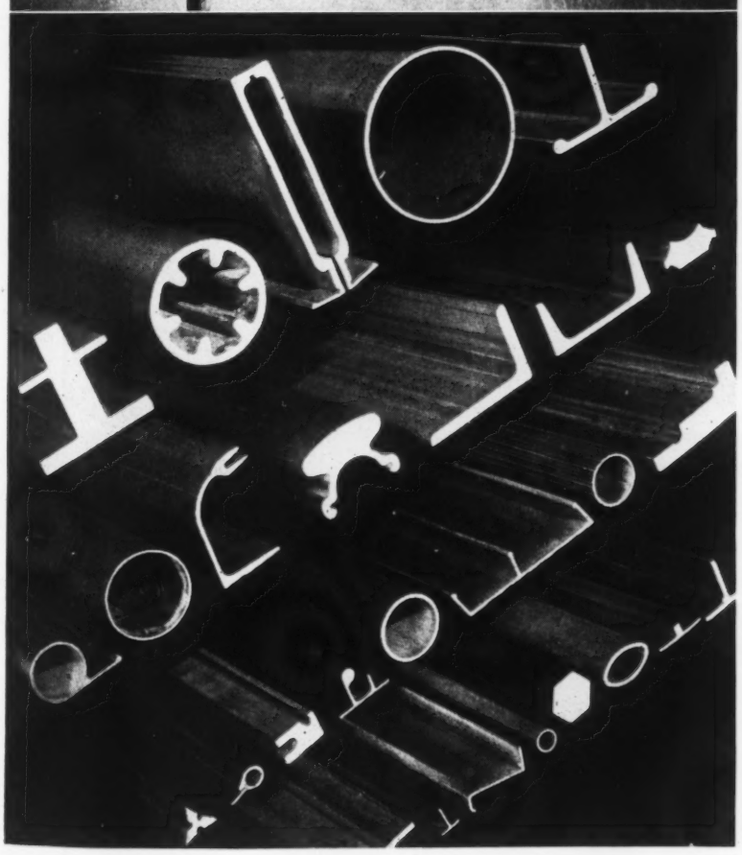
Philadelphia Steel & Wire Corp., Penn St. and Belfield Ave., Philadelphia.
(a) Drop press steel stampings, in all sizes suitable for presses up to 10 tons.
(b) To customers' specifications.
(c) Heat treating facilities.

Plymouth Stamped Metal Co., The, 330-334 Harding Way St., Galion, O.
(a) Small stampings.
(b) To customers' specifications.
(c) Complete facilities.

Powell Pressed Steel Co., Hubbard, O.
(a) All types of large or small stampings.
(b) Material handling equipment, automobile, refrigerator, washing machine parts, etc.
(c) Complete facilities.

Precision Metal Workers, 3100 Carroll Ave., Chicago.
(a) Stampings and drawings suitable for presses up to 400 tons, 6 ft. x 7 ft.: of steel, stainless steel, brass, copper, bronze, and aluminum.
(b) To customers' specifications.
(c) Assembling and finishing facilities.





MAZLO Magnesium extruded shapes may serve as your key to product improvement and greater profits.

You benefit by the light weight of Magnesium, one-fourth that of iron. You gain all of the advantages offered by the extrusion process; complex shapes eliminate the need for expensive machining and assembly operations, and place metal only where needed.

Low cost per piece—MAZLO extrusions usually cost no more than similar parts in other metals.

MAZLO engineering service offers you the assistance of men who have been working for years on problems of achieving lightness. Let them help you determine how MAZLO Magnesium Alloys will enable you to go *very* light most economically. *Sales Agent:* Aluminum Company of America, 1703 Gulf Building, Pittsburgh, Pennsylvania.

MAZLO

AMERICAN MAGNESIUM CORPORATION

Q

Quadriga Mfg. Co., The, 213 W. Grand Ave., Chicago.
(a) Stampings of any material that can be worked in punch press up to 150-ton, 4 in. depth of draw.
(b) Washers, radio, automobile and any other machine parts.
(c) Complete facilities.

R

Raymond Mfg. Co., Div. Associated Spring Corp., Corry, Pa.
(a) Small stampings of steel, brass, phosphor bronze, Monel, etc.
(b) Springs, wire forms, etc.
(c) Heat treating facilities.

Reliable Spring Co., The, 3167 Fulton Rd., Cleveland.
(a) Blanking, forming, perforating, of wire, strip or plate, in steel, stainless steel, brass, phosphor bronze, etc., 1/16 in. thick x 4 in. dia.
(b) Springs, machine fittings, etc.
(c) Heat treating and assembling facilities.

Reliance Die & Stamping Co., 1261 Claybourn Ave., Chicago.
(a) Blanking, forming, perforating of brass, aluminum, bronze, steel and stainless steel.
(b) To customers' specifications.
(c) Assembling facilities.

Revere Products Corp., Phoenix, N. Y.
(a) Blanking, forming or drawing from light metals, steel, bronze, copper, stainless steel, aluminum, and brass, blanking to ¼ in. thick, forming to 36 in. long, drawing to 4 in. deep.
(b) Oil retainers, washers, escutcheons, etc.
(c) Complete facilities.

Reisner Mfg. Co., W. H., Hagerstown, Md.
(a) Steel, brass, bronze, aluminum, nickel, silver, up to 4 in.
(b) To customers' specifications.
(c) Information not available.

Rockford Metal Specialty Co., 716 Cedar St., Rockford, Ill.
(a) Drawing, forming, piercing of steel, stainless steel, aluminum, brass and zinc, approx. 10 in. dia. x 3½ in. cups; up to 16 in. dia. or sq. on shallow parts.
(b) Primarily automotive.
(c) Plating, riveting, welding.

Rockwood Sprinkler Co., 52 Harlow St., Worcester, Mass.
(a) Medium-heavy deep drawing and stamping of brass, bronze, hot and cold-rolled steel, .02-.375 in. thick, 1-12 in. blank dia.
(b) Handles, pipe unions, textile, electrical and automatic machine parts.
(c) Machining, sherardizing, parkerizing facilities.

Rome-Turney Radiator Co., Canal St., Rome, N. Y.
(a) Copper, brass and steel stampings in sizes 15 x 30 x 6 in. deep.
(b) Automobile and refrigeration.
(c) Gas and spot welding.

S

Scovill Mfg. Co., Waterbury, Conn.
(a) Brass, bronze, nickel silver, copper, steel, aluminum and other base metal stampings, drawn shell and formed parts.
(b) To customers' specifications.
(c) Complete facilities.

Service Products Corp., 201 South Rural St., Indianapolis.
(a) Blanking, forming, drawing, perforating, both heavy and light, of steel, brass aluminum, copper and bronze; draw 6 in. deep, blanking 28 x 36 in.
(b) Automotive fans, ventilators, pumps, etc.
(c) Heat treating and machining.

Sessions, J. H., & Son, Riverside Ave., Bristol, Conn.
(a) Steel and brass, flat and formed stampings, 10 gage and lighter, up to 36 sq. in.
(b) Rivets, washers, etc.
(c) Assembling facilities.

Smith, H. A., Machine Co., Hamilton Ave. and Somerset St., Hopewell, N. J.
(a) All metal to ⅛ in. thick and 6 in. dia.
(b) Recording devices, miscellaneous assemblies and meter parts.
(c) Machining and assembling facilities.

Smith Co., Thomas, 288 Grove St., Worcester, Mass.
(a) Flat, formed, drawn or embossed, of steel, hot-rolled, cold-rolled and nonferrous metals.
(b) Diaphragms, disks, washers, cams, pawls, etc.
(c) No machining facilities.

Standard Mfg. Corp., Rock Island, Ill.
(a) Stampings of tin, aluminum, brass, copper, light steel in any size to 8 x 12 in.
(b) To customers' specifications.
(c) Complete facilities.

Standard Pressed Steel Co., Jenkintown, Pa.
(a) Flat metal stampings, cold drawn, of hot-rolled, cold-rolled, drawing steel, brass, copper and alloy steels.
(b) To customers' specifications.
(c) Complete facilities.

Standard Stamping Co. Inc., 530 W. Lovett St., Charlotte, Mich.
(a) Small metal stampings.
(b) Rolled bushings, split steel spacer tubes, spring clips, etc.
(c) Cyanide furnace, lathes, screw machine, etc.

Steel & Tubes Inc., Elyria, O.
(a) Small and medium stampings of steel, brass, aluminum, bronze, stainless steel, galvanized, up to .25 gage, blanks 12 in.
(b) Automotive, farm machinery parts, etc.
(c) Assembling facilities.

Stolper Steel Products Corp., 3258 W. Fond du Lac Ave., Milwaukee.
(a) Ferrous and nonferrous stampings.
(b) For automotive and industrial fields.
(c) Information not available.

T

Textile Shield Co., 1 Groton St., Lawrence, Mass.
(a) All kinds, up to 1/16 in. thick, specializing in deep drawn work.
(b) Radio and auto parts, ferrules, etc.
(c) Annealing facilities.

Toledo Stamping & Mfg. Co., 99 Fearing Blvd., Toledo, O.
(a) Small, medium and large stampings.
(b) Automotive, tractor, washing machine and radio parts.
(c) Heat treating and assembling facilities.

Transue & Williams Steel Forging Corp., Alliance, O.
(a) Medium-sized stampings, blanked, formed, pierced and drawn, from hot and cold rolled steel, stainless steel, aluminum and Monel metal.
(b) All sizes and types of parts.
(c) Welding, brazing, punching and riveting.

Triangle Tool Die & Stamping Co., 4822 Payne Ave., Cleveland.
(a) Blanking, forming, drawing, etc., all metals, to 75-ton capacity.
(b) Air conditioning, electrical, motor commutators, fans, etc.
(c) Machining and assembling facilities.

Truscon Steel Co., Pressed Steel Division, 6100 Truscon Ave., Cleveland.
(a) From 20-gage to heavier gage stampings.
(b) Refrigerator, automotive, housings, washing machine, etc.
(c) None.

Turner & Seymour Mfg. Co., The, Torrington, Conn.
(a) Small stampings of steel, brass, copper, bronze, Monel, stainless steel, 14 in. dia., and 4 in. draw.
(b) To customers' specifications.
(c) Assembling facilities.

U

U. S. Indestructible Gasket Co., 829 E. 15th St., Brooklyn.
(a) Flat and formed, up to 8 in. round, square or irregular, x ⅛ in. thick, of steel, lead, brass, copper, bronze, aluminum, Monel, etc.
(b) Gaskets, washers, disks, rings.
(c) Machining and assembling facilities.

W

Wagner Specialty Co., P. O. Box 404, Burlington, Wis.
(a) Blanking, forming up to 10 gage material in steel, brass, copper, stainless steel, aluminum.
(b) Washers, rings, perforated plates, pump parts, handles, etc.
(c) Machining and assembling facilities.

Wall Mfg. Supply Co., P., 3126 Preble Ave., Pittsburgh.
(a) Drawn, max. blank 20 in., max. gage 16; flat in gages from 12 to 30 inclusive; of steel, brass, copper, etc.
(b) To customers' specifications.
(c) Complete facilities.

Weber Bros. Metal Works, 108 N. Jefferson St., Chicago.
(a) Copper, brass, steel, aluminum, etc. to 12 in. dia.
(b) To customers' specifications.
(c) Complete facilities.

Western Cartridge Co., East Alton, Ill.
(a) Sheet metal stampings of brass, copper and copper alloys.
(b) To customers' specifications.
(c) Machining, polishing and plating.

Western Washer & Stamping Co., 2111 E. 51st St., Los Angeles.
(a) Forming and blanking, ferrous and nonferrous materials; press capacity ½ to 125 tons.
(b) Automotive, radio, airplane and other machinery.
(c) Tool shop and assembling.

Whitehead Stamping Co., 1661 W. Lafayette Blvd., Detroit.
(a) Light, medium and heavy parts, blanks from .002 in. to ⅜ in. thick, 1/16 in. to 18 in. diameter.
(b) Special washers, cups, collars, retainers, shims, etc.
(c) Complete facilities.

Williams, H. E., Products Co., 100-108 S. Main St., Carthage, Mo.
(a) Light stampings, steel and nonferrous metals, press size to 50 tons capacity.
(b) Automotive, etc.
(c) Turret lathes, spot welders, plating.

Williamsport Die & Machine Co., 618 Day St., Williamsport, Pa.
(a) Medium and lightweight stampings of sheet or bar stock.
(b) To customers' specifications.
(c) Machining and some heat treating facilities.

Winchester Repeating Arms Co., Div. of Western Cartridge Co., New Haven, Conn.
(a) Brass, copper and copper alloy stampings.
(b) To customers' specifications.
(c) Machining, polishing and plating.

Worcester Pressed Steel Co., 100 Barber Ave., Worcester, Mass.
(a) Pressed metal stampings from ½ in. to 4 ft. dia., in lengths up to 7 ft., using material from .0002 to ½ in. thick.
(b) Automotive, airplane, oil burner, vacuum cleaner, transmission parts, etc.
(c) Complete facilities.

Worcester Stamped Metal Co. Inc., 9 Hunt St., Worcester, Mass.
(a) Light and heavy stampings of steel, brass, aluminum, copper and stainless steel, large and small.
(b) To customers' specifications.
(c) Annealing and hardening facilities.

Wrought Washer Mfg. Co., 2102 S. Bay St., Milwaukee.
(a) Stampings, blanking, forming, drawing, extruding, in all ferrous and nonferrous metals. Presses 300 ton capacity; material up to 1¼ in. thick.
(b) Washers, expansion plugs, automotive, etc.
(c) Complete facilities.

Y

Yarman & Erbe Mfg. Co., Rochester, N. Y.
(a) Sheet metal and pressed steel parts.
(b) To customers' specifications.
(c) Engineering design, complete production facilities.

York Corrugating Co., York, Pa.
(a) Sheet steel stampings, 16 gage.
(b) Automotive stampings, boiler jackets, stoker casings, gasoline pumps, etc.
(c) Assembling and welding facilities.

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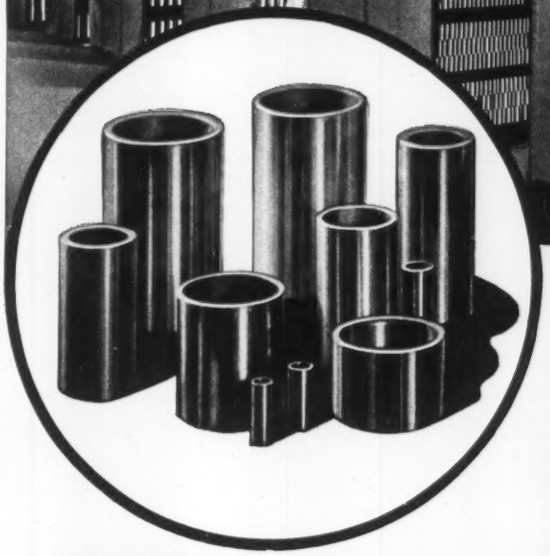
Stock Bearings are READY!



● When time means money what a relief to know that you can get the bearing you need quickly and economically. Completely machined and finished Bunting Standardized Bronze Bearings for production needs or plant maintenance save you time and money. These and Bunting Precision Machined Bearing Bronze Bars await your call in Bunting warehouses and leading mill supply houses in all industrial centers. Write for catalog. The Bunting Brass & Bronze Company, Toledo, Ohio.

BUNTING

BRONZE BUSHINGS • BEARINGS

PRECISION BRONZE BARS • BABBITT METALS

Forgings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of forgings; (b) Names of forged machine parts customarily produced; and (c) Machining or heat treating facilities.

A

Allegheny Forging Co., 507 Liberty Ave., Pittsburgh.
(a) Drop forgings and flat die work of steel, carbon or any alloy, in any size.
(b) Especially hollow shafts, etc.
(c) Complete facilities.

Allegheny-Ludlum Steel Corp., Oliver Bldg., Pittsburgh.
(a) Disks to 24 in. dia. x 5 in. thick; rings, max. 24 in. o.d. x 20 in. i.d. x 4 in. thick; also special shapes; of high speed steels, alloy and carbon tool steels, stainless and Nitralloy.
(b) Hardened machine parts, etc.
(c) Complete facilities.

Alliance Drop Forging Co., P. O. Box 427, Alliance, O.
(a) Drop forgings.
(b) To customers' specifications.
(c) Information not available.

Aluminum Company of America, Gulf Bldg., Pittsburgh.
(a) Aluminum and magnesium alloy hammered and pressed forgings, in any sizes.
(b) Largely aircraft and aircraft engine parts.
(c) Heat treating facilities.

American Brass Co., Waterbury, Conn.
(a) Hot-pressed copper, brass, bronze, nickel, silver, and special copper alloys in small sizes and shapes.
(b) To customers' specifications.
(c) None.

American Hollow Boring Co., Erie, Pa.
(a) Hollow-bored forgings.
(b) Piston rods, clutch shafts, hydraulic cylinders, etc.
(c) Complete facilities.

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
(a) Hammered and pressed forgings, of magnesium alloys, in any size.
(b) To customers' specifications.
(c) Heat treating facilities.
See advertisement, Page 47-D

Atlas Drop Forge Co., 209 W. Mount Hope Ave., Lansing, Mich.
(a) All sizes and shapes, any material, from few ounces to 500 lbs.
(b) Farm implements, tractors, railroad, aviation, automotive, etc.
(c) Complete heat treating facilities.

Atwater Mfg. Co., Plantsville, Conn.
(a) Drop and upset forgings of steel and brass.
(b) To customers' specifications.
(c) Information not available.

B

Bay City Forge Co., Erie, Pa.
(a) Flat die forgings to 7000 lbs.
(b) Crankshafts, connecting rods, rolls, pinions, etc.
(c) Complete facilities.

Benton Harbor Malleable Industries, Benton Harbor, Mich.
(a) Drop hammer steel forgings to 80 pounds.
(b) All types of parts.
(c) Heat treating facilities.

Bethlehem Steel Co., Bethlehem, Pa.
(a) Open die forgings to 225,000 lbs. in all grades of carbon and alloy steels—solid and hollow. Drop forgings from 1 lb. to 350 lbs. Also upset forgings.
(b) Shafts, rotors, rolls, gears and other press and hammer forgings.
(c) Complete facilities.

Billings & Spencer Co., The, 1 Laurel St., Hartford, Conn.
(a) All types in brass, bronze, stainless steel, alloys, straight carbon steel, Monel metal and tool steel; to 100 lbs.
(b) Airplane, automobile, machine tool parts, gas and diesel engine, conveyor, mining machinery, type-writer parts, etc.
(c) Complete facilities.

Blakeslee Forging Co., The, Plantsville, Conn.
(a) Light drop forgings to 25 lbs., all grades steel, brass, bronze and copper.
(b) To customers' specifications.
(c) Machining, normalizing and annealing.

Bonney Forge & Tool Works, Allentown, Pa.
(a) Drop forging from 1 ounce to 8 lbs. of any grade steel, alloy or carbon; also small upset forgings.
(b) Machine handles, etc.
(c) Complete facilities.

Bradley, C. C., & Son Inc., 432 N. Franklin St., Syracuse, N. Y. (Affiliated with Irving Forgings Corp., Syracuse, N. Y.)
(a) Small drop forgings up to 5 lbs., hammer type forgings in all sizes, small upset forgings 1 in. and under; flat die forgings; of carbon, alloy, tool steel, stainless, Monel, Nitralloy, bronze, aluminum.
(b) Weldless rings, spindles, gear blanks, disks, blocks, valve and pump trim, etc.
(c) Complete facilities.

Brewer-Titchener Corp., 111 Port Watson St., Cortland, N. Y.
(a) Hammer forgings 1000-4000 lbs.; upset forgings ¾-4 in.; and any forgings within the range of 1 ounce to 15 lbs.
(b) Automotive parts.
(c) Complete facilities.

Brown-Fayro Co., The, 940 Ash St., Johnstown, Pa.
(a) Hammered, upset, pressed, rolled, and welded, small and medium.
(b) Mine, industrial and railroad cars, etc.
(c) Machining facilities.

Buckeye Forging Co., 10001 Harvard Ave., Cleveland.
(a) Small forgings of carbon and alloy steels, stainless steels, brass and copper.
(b) Automotive, tractor, tank, etc.
(c) Machining facilities.

C

Camden Forge Co., Mt. Ephraim Ave. & P. & R. S. L., Camden, N. J.
(a) Hammered or pressed forgings of carbon or alloy steel, from 50 lbs. to 75 tons.
(b) Spindles, screws, cams, eccentric shafts, nitrided parts, etc.
(c) Complete facilities.

Cann & Saul Steel Co., 516 Commerce St., Philadelphia.
(a) Stainless, alloy and open hearth steel forgings.
(b) Rings, gears, hubs, bars, disks, rings, flanges, etc.
(c) Heat treating facilities.

Cape Ann Tool Co., 146 Granite St., Pigeon Cove, Mass.
(a) All types and sizes of drop and upset forgings in ferrous and nonferrous metals.
(b) To customers' specifications.
(c) Heat treating facilities.

Carnegie-Illinois Steel Corp., 434 Fifth Ave., Pittsburgh.
(a) All type forgings produced with open dies, in all types of steel. Round—body diameter 68 in., max. collar diameter, 90 in., max. weight 220,000 lbs. Rectangular—up to 30 in. max. thickness, 150 in. max. width, with max. weight of 220,000 lbs. Hollow rounds—max. outside diameter 140 in.
(b) Marine, axles, bars, bridge pins, crankshafts, hexagon shafts, propeller shafts, rotors, locomotive, back up rolls, sleeves, pinions, reduction gears, spindles, mill housings, etc.
(c) Complete facilities.

Carpenter Steel Co., The, 120 Bern St., Reading, Pa.
(a) Simple forgings made on flat dies in all S.A.E., stainless and tool steels up to 3000 lbs.
(b) Rings, disks, blocks, simple shafts, axles, etc.
(c) All heat treating facilities; minimum of machine work.

Champion Machine & Forging Co., 3695 E. 78 St., Cleveland.
(a) All type steel forgings to 800 lbs.
(b) To customers' specifications.
(c) Complete facilities.

Chase Brass & Copper Co. Inc., 236 Grand St., Waterbury, Conn.
(a) Brass, naval brass, copper and copper alloy, and Olympic bronze.
(b) Automotive, aircraft, refrigeration parts, air valves, etc.
(c) Annealing, machining, polishing and plating facilities.

Clapp, E. D., Mfg. Co., 305 Genesee St., Auburn, N. J.
(a) Drop forgings of stainless steel, Monel, brass, bronze, copper, etc.
(b) Aircraft, automotive, railroad, tractor, etc.
(c) Complete facilities.

Cleveland City Forge Co., 4501 Lakeside Ave., Cleveland.
(a) Drop and upset forgings of carbon and alloy steel, from few ounces to several hundred pounds.
(b) To customers' specifications.
(c) Complete facilities.

Cleveland Hardware & Forging Co., 3270 E. 79th St., Cleveland.
(a) Drop and upset forgings in steel and brass.
(b) To customers' specifications.
(c) Complete facilities.

Clifford-Jacobs Forging Co., Box 264, Champaign, Ill.
(a) Drop forgings.
(b) Steel flanges, center plates, wedges, hubs, gears, conn. rods.
(c) Information not available.

Cornell Forge Co., 1659 W. 74th St., Chicago.
(a) All type drop forgings, from fraction of an ounce to 15 lbs.; carbon steel, alloy, Monel, stainless steel.
(b) Cams, crankshafts, pins, gears, hubs, valves, connecting rods, etc.
(c) Heat treating, annealing, sandblasting and some machining.

Crucible Steel Co. of America, 405 Lexington Ave., New York.
(a) All types of forgings in carbon and alloy grades, to 40 tons max. weight.
(b) Crankshafts, propeller shafts, piston rods, rams, gun forgings, etc.
(c) Complete facilities.

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MOLY

D

Davenport Besler Corp., 2305 Rockingham Rd., Davenport, Ia.
(a) Drop forgings and open steam hammer forgings.
(b) Crankshafts, connecting rods, levers, automotive and railway equipment.
(c) Complete facilities.

Delaware Alloy Forge Co., 2300 E. Tioga St., Philadelphia.
(a) Flat die steam hammer work in stainless steel, tool steel, Nitralloy, Monel metal, bronze and other alloys from 1-5000 lbs.
(b) Seat rings for large valves, knitting machine cylinders, paper machinery shafts, and gears.
(c) Complete facilities.

Dow Chemical Co., The, Midland, Mich.
(a) Magnesium alloy forgings.
(b) To customers' specifications.
(c) Heat treating facilities.
See advertisement, Page 7-D

Drop Dies & Forgings Co., 3092 E. 63rd St., Cleveland.
(a) Drop forgings up to 25 lbs.
(b) To customers' specifications.
(c) None.

Dyson, Jos., & Sons Inc., 5125 St. Clair Ave., Cleveland.
(a) Flat die forgings in open-hearth and alloy steels in any size or type.
(b) Shafts, crankshafts, gears, nuts, sleeves and forks.
(c) Complete facilities.

E, F

Ellwood City Forge Co., Box 589, Ellwood City, Pa.
(a) Steel forgings from 25 to 35,000 lbs.
(b) Crankshafts, aircraft, automobile, gas, steam, or diesel engines.
(c) Complete facilities.

Endicott Forging & Mfg. Co. Inc., Endicott, N. Y.
(a) Drop and upset forgings, of carbon and alloy steels, Monel, stainless, Nitralloy, brass, copper and bronze, from 2 ozs. to 80 lbs.
(b) Gear blanks, crankshafts, connecting rods, rocker arms, etc.
(c) Heat treating facilities.

Federal Drop Forge Co., 2200 S. Washington Ave., Lansing, Mich.
(a) Drop forgings up to 25 lbs.
(b) To customers' specifications.
(c) Information not available.

Finkl, A., & Sons Co., 2011 N. Southport Ave., Chicago.
(a) Hammer and press forgings in carbon and alloy steels from 5-50,000 lbs.
(b) Shafts, rolls, rings, gear and pinion blanks, etc.
(c) Complete facilities.

Forging & Casting Corp., The, 1101 Wanda St., Ferndale, Mich.
(a) Smooth hammered forgings, of S.A.E. grades of steel, from ½ lb.-1500 lbs.
(b) Rings, blocks, disks, and irregular shapes.
(c) Annealing facilities.

Forgings & Stampings Inc., 23rd Ave. and Seventh St., Rockford, Ill.
(a) Drop forgings.
(b) To customers' specifications.
(c) Information not available.

G

General Drop Forge Co. Inc., 1738 Elmwood Ave., Buffalo.
(a) Hammered and upset forgings, of carbon, stainless, Monel, brass, copper and alloys, 1 oz.-100 lbs.
(b) Rings, gears, stem pinions, side gears, connecting rods, etc.
(c) Heat treating facilities.

Globe Forge & Foundries Inc., 101 Greenway Ave., Syracuse, N. Y.
(a) Drop and upset forgings in carbon and alloys from few ounces to 125 lbs.
(b) Differential, transmission gears.
(c) Complete facilities.

Great Lakes Forge Co., 612 N. Michigan Ave., Chicago.
(a) Drop and upset forgings, of alloy and carbon steel, to 100 lbs.
(b) To customers' specifications.
(c) Complete heat treating facilities.

H, I, J

Hammond & Irving Inc., 254 North St., Auburn, N. Y.
(a) Steam hammer forgings in alloy and tool steels, stainless, Nitralloy and Monel metals, up to 1200 lbs.
(b) Weldless rings, gear blanks, shafts, hammered bars, etc.
(c) Complete facilities.

Harris-Thomas Drop Forge Co., 126 Harshman St., Dayton, O.
(a) Drop forgings.
(b) To customers' specifications.
(c) Information not avalable.

Hartford Drop Forge Corp., 846 Windsor St., Hartford, Conn.
(a) Die and drop forgings in steel, copper, brass, Monel, up to 7 lbs.
(b) Gears, levers, loom parts, and any part to customers' specifications.
(c) None.

Harvey Spring & Forging Co., Racine, Wis.
(a) Drop and upset forgings.
(b) To customers' specifications.
(c) Heat treating and machining facilities.

Heppenstall Co., 4622 Hatfield St., Pittsburgh.
(a) Forgings of carbon, brass, copper and alloys, up to 45,000 lbs. rough turned weight.
(b) Shafts, crankshafts, die blocks, shear knives, rolls, etc.
(c) Complete facilities.

Herbrand Corp., Fremont, O.
(a) Drop forgings.
(b) Automobile, etc.
(c) Heat treating facilities.

International Nickel Co. Inc., 67 Wall St., New York.
(a) Monel, K Monel, nickel, and Inconel—max. slabs 20 x 30 x 10,000 lbs. or 25 in. dia. x 11,000 lbs.
(b) Miscellaneous parts.
(c) Complete facilities.

Interstate Drop Forge Co., 4051 N. 27th St., Milwaukee.
(a) Drop and upset forgings of carbon, alloy and stainless steel.
(b) Levers, gears, segments, hydraulic fittings, connecting rods, crankshafts, etc.
(c) Heat treating facilities.

Jersey Forging Works, 803 Jersey Ave., Jersey City, N. J.
(a) Alloy steel and Standard S.A.E. steel forgings.
(b) Gear blanks, rings, sleeves, rolls, shafts, spindles, etc.
(c) Complete facilities.

Johnston & Jennings Co., 872 Addison Rd., Cleveland.
(a) Flat die forgings in plain carbon and alloy steels, 1 to 5 tons.
(b) Spindles, solid and hollow-bored, rings, blanks, arbors, shafts, gears, etc.
(c) Complete machine shop facilities.

Jones & Laughlin Steel Corp., Third and Ross St., Pittsburgh.
(a) Smooth, rough turned and finished forgings of any size.
(b) To customers' specifications.
(c) Annealing, normalizing and heat treating.

K, L

Kortick Mfg. Co., 345 First St., San Francisco.
(a) Drop forgings.
(b) Bolts, nuts, washers, etc.
(c) Information not available.

Kraeuter & Co. Inc., 585 Eighteenth Ave., Newark, N. J. (Drop Forging Div., Nye Ave. and S. Twentieth St., Irvington, N. J.
(a) Closed die and upset forgings, of carbon, Monel, stainless steel, bronze and alloy steels, ½ oz. to 20 lbs.
(b) To customers' specifications.
(c) Limited facilities.

Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago.
(a) Upset, drop and hammer forgings, of all steels, ferrous alloys, brass, aluminum, etc., from fraction of an ounce to 20 tons.
(b) Bars, rings, flats, axles, bushings, crankshafts, rods, piston rods, valve bodies, etc.
(c) Complete facilities.

Lakeview Forge & Clevis Co., Pittsburgh Ave., Erie, Pa.
(a) Drop forgings up to 10 lbs. in alloy or carbon steel.
(b) To customers' specifications.
(c) Heat treating facilities.

Lamson & Sessions Co., The, Cleveland, Chicago and Birmingham, Ala.
(a) Small hot and cold forgings of any metal or alloy.
(b) Bolts, nuts, cotters, cap screws and special hot and cold upset products.
(c) Complete facilities.

Lansdowne Steel & Iron Co., Morton, Pa.
(a) Hollow forgings.
(b) To customers' specifications.
(c) Complete facilities.

Lansing Drop Forge Co., Logan and Albert Sts., Lansing, Mich.
(a) Drop forgings to 80 lbs., upset forgings, coined and machined forgings, of all grades of carbon, Monel metal, aluminum and other alloys, from 2 ozs. to about 80 lbs.
(b) Steering arms, shift levers, small crankshafts, camshafts, shock absorber arms, rocker arms, gears, housings, etc.
(c) Complete facilities.

Latrobe Electric Steel Co., Latrobe, Pa.
(a) High speed steel and stainless steel forgings, blocks approx. 16 in. cube, flats approx. 20 x 10.
(b) Shear blades, disks, etc.
(c) Heat treating facilities.

Leard, William, Co. Inc., New Brighton, Pa.
(a) Hammered and hydraulic pressed steel forgings up to 25,000 lbs.
(b) Crankshafts, connecting rods and other type forged steel shafts.
(c) Complete facilities.

Lindell Drop Forge Co., S. Logan and N. Y. C. R. R., Lansing, Mich.
(a) Carbon and alloy steel forgings, from 1 oz. to 75 lbs.
(b) For automotive, agricultural, mining machinery, etc.
(c) Limited machining.

M

Machinery Forging Co., The, 5450 Hamilton Ave., Cleveland.
(a) Flat die forgings of carbon and alloy steels, 1 to 2000 lbs.
(b) Rings, disks, blocks, spindles, bars, hubs, etc.
(c) Rough turning only.

Manganese Steel Forge Co., Richmond St. at Castor Ave., Philadelphia.
(a) Hammered, upset and pressed forgings of manganese steel.
(b) Bolts, pins, bushings, shafts, wear plates, etc.
(c) Complete facilities.

Merrill Brothers, 56 Arnold Ave., Maspeth, Queens, N. Y.
(a) Drop forgings of steel and alloys, from fraction of oz. to 100 lbs. or more.
(b) Turnbuckles, clevis nuts, shackles, eyebolts, hexagon sleeve nuts, etc.
(c) Complete facilities.

Mesta Machine Co., Box 1466, Pittsburgh.
(a) Very large steel and alloy steel forgings.
(b) Shafts, pinions, rolls, etc.
(c) Complete facilities.

Midvale Co., The, Nicetown, Philadelphia.
(a) Press or hammer forgings, solid or hollow, in carbon or alloy steel.
(b) All types of parts.
(c) Complete facilities.

Mitchell Steel Co., The, Stockyards Station, Cincinnati.
(a) Steam hammer forgings in plain carbon, alloy and stainless steel.
(b) All types of machine parts, railroad, marine, etc.
(c) Complete facilities.

Modern Die & Drop Forge Co., 2600 W. 139th St., Blue Island, Ill.
(a) Drop forgings.
(b) To customers' specifications.
(c) Information not available.

Rolled Steel Construction Saves 75% on Fabrication Time, Effects Consequent Reduction in Costs . . .

HERE'S 11,600 pounds of proof that rolled steel construction can be used for faster large-gear fabrication. This gear — with an inside diameter 9'11¼" — was completed in one week. Experience in previous similar jobs showed that it would have required nearly a month to build the same gear with other methods of fabrication.

This gear was made for a user of quarrying equipment. It is built up of six segments. The width of the tooth face is 11¾".

Other widely varied rolled steel applications further prove its versatility, speed of fabrication, economy. In a large rayon plant, for example, all-welded, rolled steel construction made economically possible the fabrication of a continuous spinning machine that sets new standards of precision, produces higher quality yarn. Railroad locomotive cylinders built by welding U·S·S Rolled Steel plates reduced weight 25%—and reduced cost 24%.

Rolled Steel Construction Cuts Time, Lowers Costs in Many Types of Industry

For heavy equipment or light, intricate jobs or comparatively simple ones, this type of fabrication has aided materially in producing better equipment, in less time, at lower cost. A listing of those companies who have used rolled steel construction to save time and money, make their products stronger, longer-lasting and better-looking, reads like a blue book of industry.

The Right Steel in the Right Place

When you fabricate with rolled steel construction, you can put steels with special properties to work in strategic spots. Combine them with one another, with castings or plain steels as the need dictates, to combat destructive forces, reduce weight and give equipment longer life. We offer designers and fabricators, foundries and welderies, steels in widest variety for rolled steel construction. Among them, the special steels, U·S·S Cor-Ten, U·S·S Abrasion Resisting Steels U·S·S Carilloy Alloy Steels, U·S·S Heat Resisting Steels and U·S·S Stainless Steels. And at your command is our wide experience in putting these steels to work where they will best perform.

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Mondie Forge Co. Inc., 10300 Berea Rd., Cleveland.
(a) Drop forgings up to 75 lbs., upset forgings to 4 in., also gear blanks.
(b) To customers' specifications.
(c) Machining facilities.

Moore Drop Forging Co., 36 Walter St., Springfield, Mass.
(a) Drop, upset and coined forgings.
(b) To customers' specifications.
(c) Heat treating and machining.

Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
(a) Forging in brass and aluminum copper, ½ oz. to 70 lbs.
(b) Automotive, mechanical refrigeration, air conditioning, locomotive, etc.
(c) Complete facilities.

National Forge & Ordnance Co., Irvine, Warren Co., Pa.
(a) Flat die press and hammered steel forgings.
(b) Heavy-duty crankshafts, etc.
(c) Complete facilities.

National Lock Washer Co., 40 Hermon St., Newark, N. J.
(a) Drop forgings.
(b) Spring washers, and parts for busses, railroad, electrical, etc.
(c) Heat treating and machining.

O

Octigan Forge Co., 2824 S. Lowe Ave., Chicago.
(a) Drop forgings.
(b) To customers' specifications.
(c) None.

Ohio Forge & Machine Corp., 3010 Woodhill Rd., Cleveland.
(a) Drop, upset and flat hammer steel forgings in all sizes.
(b) Gear blanks and other machine parts.
(c) Complete heat treating, machining for gear shafts only.

O'Leary & Son Co., Arthur J., 5757 West 65th St., Chicago.
(a) Upset and steam hammered forgings of medium and mild steels and alloys, to 5 in. dia. upsetting and to 10 in. dia. steam hammer.
(b) To customers' specifications.
(c) Complete facilities.

Oliver Iron & Steel Corp., N. E. Corner S. 10th and Muriel Sts., Pittsburgh.
(a) Small forgings in iron, steel and alloys in sizes of 8 in., and weight of 5 lbs.
(b) Bolts, nuts, rivets, etc.
(c) Complete facilities.

Owensboro Forging Co., Owensboro, Ky.
(a) Drop forgings.
(b) To customers' specifications.
(c) Heat treating facilities.

P

Park Drop Forge Co., The, 730 E. 79th St., Cleveland.
(a) All types of drop steel forgings up to 4000 lbs. each.
(b) Crankshafts, connecting rods, camshafts, axles, gears, etc.
(c) Complete machining, heat treating.

Pittsburgh Forgings Co., Riverside Forge & Machine Co. Div., Jackson, Mich.
(a) Steam drop forgings, round and symmetrical, of plain carbon and alloy steel, from 4 lbs. to 40 lbs.
(b) Auto hubs, gears, wheels, flanges, pulleys, casters, etc.
(c) Machining facilities.

Pittsburgh Forgings Co., Coraopolis, Pa.
(a) Drop and upset forgings, from 1 oz. to 350 lbs.
(b) Automotive, tractor, farm implement, railroad car, machine tool parts, and gear blanks.
(c) Complete heat treating.

Pittsburgh Trolley & Forge Co., 117 Water St., Pittsburgh.
(a) Forgings in carbon and alloy steels, up to 2000 lbs.
(b) Spindles, shafts, gears, rings, etc.
(c) Complete facilities.

Poor & Co., Canton Forge & Axle Works, 2027 Dueber Ave., S. W., Canton, O.
(a) Drop die and upset forgings in carbon and alloy steels, from 1 to 350 lbs.
(b) Spindles, levers, gears, etc.
(c) Heat treating facilities.

Porter Forge & Furnace Inc., 6 Ashland St., Everett, Mass.
(a) Drop forgings of standard and special steels and metals.
(b) To customers' specifications.
(c) Heat treating facilities.

Portland Forge & Fdry. Co., Portland, Ind.
(a) Board hammer, upset forgings of steel bars, up to 60 lbs.
(b) Gears, etc.
(c) Complete facilities.

Pratt & Letchworth Co. Inc., 189 Tonawanda St., Buffalo.
(a) Drop forgings of steel, 1 to 35 lbs.
(b) Railroad parts.
(c) Could be arranged.

R

Revere Copper & Brass Inc., (Dallas Div.) 2200 N. Natchez Ave., Chicago.
(a) Die pressed and hammered forgings, of nonferrous alloys, from fraction of ounce to 19 lbs.
(b) To customers' specifications.
(c) Complete facilities.

Rhode Island Tool Co., 148 W. River St., Providence, R. I.
(a) Drop forgings of carbon, alloy and stainless steels, 10 in. dia., 1½ in. thick; 2 in. dia., 18 in. long.
(b) Grippers, wrenches, eyebolts, gear blanks, etc.
(c) Heat treating facilities.

Rockford Drop Forge Co., 1033 Ninth St., Rockford, Ill.
(a) Drop forgings.
(b) Automotive and industrial clutches, etc.
(c) Information not available.

Rome Mfg. Co. Div., Revere Copper & Brass Inc., Railroad St., Rome, N. Y.
(a) Hot pressed forgings in brass, copper and related alloys.
(b) To customers' specifications.
(c) Complete facilities.

S

St. Pierre Chain Corp., 50 Frank St., Worcester, Mass.
(a) All types of forgings of alloys, soft steels, etc., from 1 oz. to 50 lbs.
(b) Automobile, airplane and other machine parts.
(c) Complete facilities.

Salem Tool Co., Salem, Ohio.
(a) Hammered and small pressed forgings up to 15 lbs.
(b) For mining machine parts.
(c) Adequate facilities.

Scovill Mfg. Co., Waterbury, Conn.
(a) Made-to-order forgings from brass, bronze, copper, nickel silver and aluminum in all sizes.
(b) To customers' specifications.
(c) Complete facilities.

Shuler Axle Co. Inc., 2901 S. Second St., Louisville, Ky.
(a) All type forgings in carbon, alloy steel, and brass, from 1 to 300 lbs.
(b) Automotive and trailer axles.
(c) Complete facilities.

Shunk Mfg. Co., Bucyrus, O.
(a) Small hammered forgings of SAE steels, 1-50 lbs.
(b) For road building machinery.
(c) Complete facilities.

Spencer Mfg. Co., Spencer, O.
(a) Rolled, hammered and upset forgings, in any size.
(b) Axle forgings.
(c) Heat treating facilities.

Spicer Mfg. Corp., Toledo, O.
(a) Drop, upset and pressure forgings in plain and alloy steels, up to 30 lbs.
(b) Universal joint yokes, forks, gears, shafts, etc.
(c) Complete facilities.

Steel Improvement & Forge Co., 960 Addison Rd., Cleveland.
(a) Drop hammer, upset and press forging.
(b) Machine tool, aircraft, automotive, truck and tractor, marine and coal industries.
(c) Complete facilities.

Storms Drop Forging Co., P. O. Box 1688, Springfield, Mass.
(a) Drop forgings, from fraction of ounce to 50 lbs., in all grades of forgeable materials; also hot pressed brass forgings.
(b) To customers' specifications.
(c) Complete heat treating.

Struthers Wells Titusville Corp., Titusville Forge Div., 605 E. Spring St., Titusville, Pa.
(a) All type forgings in carbon and alloy steels, 40 lbs. to 40 tons.
(b) Crankshafts, hollow-bored forged parts up to 75 ft. long, and all types of hammered steel forgings, marine, railroad and machine tools.
(c) Complete facilities.

T

Taylor Forge & Pipe Works, P. O. Box 485, Chicago.
(a) Drop, upset and hammer forgings of carbon and alloy steels, some nonferrous metals, up to 114 in. o.d.
(b) Flanges, rings, nozzles, necks, gear blanks, etc.
(c) Complete facilities.

Taylor-Wharton Iron & Steel Co., (Easton, Pa. plant), High Bridge, N. J.
(a) Upset forgings made on 2 in. to 5 in. upsetting machines.
(b) To customers' specifications.
(c) Complete facilities.

Transue & Williams Steel Forging Corp., Alliance, O.
(a) All sizes and types of drop forgings from 1 oz. to 1000 lbs. of carbon steels, alloys and nonferrous metals.
(b) Various sizes and types of connecting rods, crankshafts, camshafts, bearing caps, driveshafts and gears.
(c) Complete heat treating.

U

Union Forging Co., Endicott, N. Y.
(a) Drop and press forgings.
(b) Automotive parts.
(c) Heat treating facilities.

Universal-Cyclops Steel Corp., Cyclops Division, Titusville, Pa.
(a) Steam hammer forging of stainless and special steels, to 24 in. dia. x 5 in. thick.
(b) Rings, disks, die blocks, etc.
(c) Ample facilities.

V

Vichek Tool Co., 3001 E. 87th St., Cleveland.
(a) Small forgings to 4 lbs., of carbon and alloy steels.
(b) Clamps, clips, gear shift levers, cutter forgings, etc.
(c) Complete facilities.

Vulcan Steam Forging Co., 223-257 Rano St., Buffalo, N. Y.
(a) Open die forgings of carbon, alloy, tool and stainless steels, and nonferrous metals.
(b) Gear blanks, crankshafts, piston rods, levers, spindles, rolls, weldless rings, shaped work.
(c) Complete facilities.

W

Wilcox Mfg. Co., The D., N. Chestnut and E. Allen Sts., Mechanicsburg, Pa.
(a) Drop forgings of alloy and carbon steel, 1 oz. to 30 lbs.
(b) To customers' specifications.
(c) Heat treating facilities.

Williams, J. H., & Co., 400 Vulcan St., Buffalo.
(a) Drop forgings in steel and nonferrous metal from ½ oz. to 350 lbs.
(b) Structural forged parts, gears, levers, cams, cranks, etc., for machine tools, gas engines, compressors, aircraft, etc.
(c) Complete facilities.

Wyman-Gordon Co., Worcester, Mass., and Harvey, Ill.
(a) Drop hammer, upset and press forgings in steel and aluminum from 10 to 500 lbs.
(b) Automotive and aviation.
(c) Heat treating facilities.

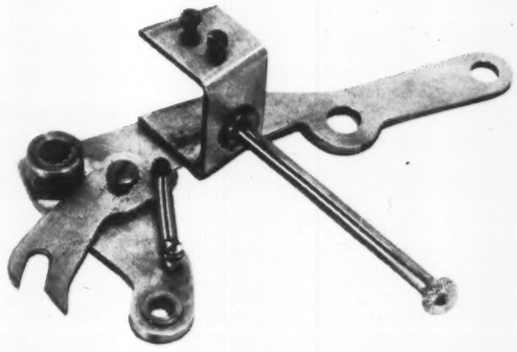
GREIST

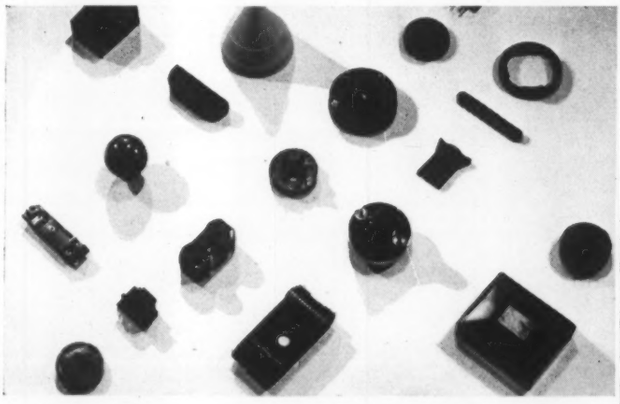
MANUFACTURING COMPANY

NEW HAVEN, CONN.

CONTRACT MANUFACTURERS

Equipped to engineer your machine from an idea to a finished product.





Experience THAT MAKES EVERY MOLDED JOB A BARGAIN

An Auburn bid on any plastic molding job, big or little, includes no premium for quality. Quality is there, but because of Auburn's long experience in handling all types of plastics and in molding a wide range of products, it comes as an integral part of every job.

Auburn's cost-cutting, quality-insuring experience . . . the care and skill with which your dies are engineered . . . and the long series of inspections every product must pass, are your guarantees of a molded plastic job in which quality is outstanding, but in which price is often surprisingly low.

On your next molded plastic job . . . be sure to ask for an Auburn bid.

Established 1876

MOLDED PLASTICS DIVISION OF

AUBURN BUTTON WORKS, Inc.

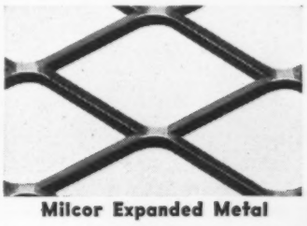
AUBURN, N. Y.—New York, Chicago, Detroit, Cleveland, Rochester, Boston

Step up the sales appeal of your machines — with MILCOR Expanded Metal

You Save Money — and do a better job —with MILCOR Expanded Metal

. . . for machine guards— partitions — shelving — a hundred other uses

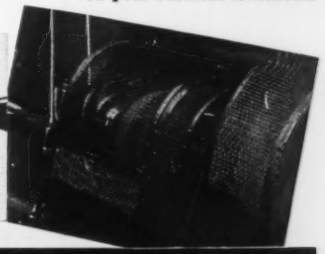
Milcor Expanded Metal helps you improve the utility of your finished product, or reduce its cost, or both. You enjoy designing freedom —for it can be cut in any direction to form the desired shape economically. Strands cannot ravel or loosen. Stronger than solid metal, because expanding process increases tensile strength. Costs no more than perforated metal. Provides adequate protection, light, ventilation, vision. Used in many industries for product construction and factory maintenance purposes. ½", ¾" and 1½" standard mesh — 26 to 9 gauge stock in sheets 8' long and 4', 6' and 8' width. Special fabricating facilities for unusual jobs. Enhance your reputation as an advanced designer — use Milcor Expanded Metal for clean-cut lines that fit in with modern design. F-83



Milcor Expanded Metal

Free Sample Kit!

Send for the Milcor Expanded Metal Sample Kit, containing samples of all six standard sizes, and tables of weights, etc. Write today on your business letterhead.



Milcor Flat Expanded Metal

MILCOR STEEL COMPANY

MILWAUKEE, WISCONSIN CANTON, OHIO

CHICAGO, ILL., KANSAS CITY, MO., LA CROSSE, WIS., ATLANTA, GA., NEW YORK, N. Y., ROCHESTER, N. Y., BALTIMORE, MD.

Sales Offices: Minneapolis, Minn., Little Rock, Ark., Dallas, Tex., Denver, Colo., Washington, D. C., Boston, Mass.

Die Castings Producers

Reference letters beneath addresses of companies refer to: (a) Types, materials and sizes of die castings; (b) Names of die cast parts customarily produced; and (c) Machining, finishing and assembling facilities.

A

Advance Pressure Castings Inc., 34 N. 15th Ave., Brooklyn.
(a) Aluminum and zinc alloy die castings, to 5 and 12 lbs. respectively.
(b) To customers' specifications.
(c) Complete facilities.

Aluminum Co. of America, Die Casting Div., Garwood, N. J.
(a) Aluminum die castings to 20 lbs., zinc to 45 lbs., and magnesium die castings.
(b) To customers' specifications.
(c) Machining, finishing facilities.

American Magnesium Corp., 2210 Harvard Ave., Cleveland.
(a) Low and high pressure die castings of various magnesium alloys, in any size.
(b) To customers' specifications.
(c) Light machining.
See advertisement, Page 47-D

Aurora Metal Co., 614 W. Park Ave., Aurora, Ill.
(a) Aluminum bronze and silicon bronze die castings.
(b) Variety of machine parts.
(c) Complete facilities.

B

Badeger Die Casting Co., 1590 S. First St., Milwaukee.
(a) Zinc alloy and aluminum alloy die castings, all sizes.
(b) Housings for gasoline or electric motors, mechanical parts, etc.
(c) Complete facilities.

Benton Harbor Malleable Industries, Benton Harbor, Mich.
(a) Small zinc base alloy castings to 10 lbs.
(b) Parts for automotive, domestic, canning, agricultural and coin operated machines.
(c) Machining facilities.

C

Central Die Casting & Mfg. Co., 2935 W. 47th St., Chicago.
(a) Zinc alloy and aluminum die castings, from fraction of an ounce to 20 lbs.
(b) Automotive, electrical, radio, coal stoker, coin machine, etc.
(c) Machining and finishing facilities.

Cincinnati Die Casting Co., 2115 Spring Grove Ave., Cincinnati.
(a) From small to very large zinc base, high-tensile aluminum and magnesium alloy die castings.
(b) Automotive, radio, mechanical, etc.
(c) Complete facilities.

Cleveland Hardware & Forging Co., 4518 Lakeside Ave., Cleveland.
(a) Aluminum and zinc from minute to 12½ lbs.
(b) Automotive, musical machines, vacuum cleaners, sewing machines.
(c) Complete facilities.

Congress Tool & Die Co., 9030 Lumpkin Ave., Detroit.
(a) Zinc alloy die castings, to 6 lbs.
(b) Pulleys, flexible couplings, vending machine, washing machine, radio, woodworking machine and automotive parts.
(c) Complete facilities.

Continental Die Casting Corp., 9615 Grinnell Ave., Detroit.
(a) Zinc alloy die castings to 20 lbs.
(b) To customers' specifications.
(c) Complete facilities.

D

Dayton Die Casting Co., 303 Keowee St., Dayton, O.
(a) Zinc alloy, lead and tin die castings.
(b) To customers' specifications.
(c) Complete facilities.

Doehler Die Casting Co., Toledo, O. (Other plants at Batavia, N. Y., and Pottstown, Pa.)
(a) Zinc, aluminum, brass, bronze, tin, lead and magnesium die castings.
(b) All types of machine parts.
(c) Machining and finishing facilities.

Dollin Corp., 610 S. 21st St., Irvington, N. J.
(a) All sizes, in aluminum and zinc alloys.
(b) Variety of machine parts.
(c) Machining and finishing facilities.

Dow Chemical Co., Midland, Mich.
(a) Dowmetal and magnesium alloy die castings.
(b) All types of automotive, aircraft and other machine parts.
(c) None.
See advertisement, Page 7-D

Dura Co., Div. of Detroit Harvester Co., 4500 Detroit Ave., Toledo, O.
(a) Small zinc die castings.
(b) Automotive parts.
(c) Complete facilities.

E

Erie Bronze Co., Nineteenth and Chestnut Sts., Erie, Pa.
(a) Zinc and aluminum alloy die castings to 6 in. dia.
(b) Chokes, oil rings, bearings, and valve dial plates.
(c) Finishing and assembling facilities.

F

Faith Products Co., 3017 W. Carroll Ave., Chicago.
(a) Zinc base die castings to 6 in.
(b) To customers' specifications.
(c) Complete facilities.

Federal-Mogul Corp., 11031 Shoemaker Ave., Detroit.
(a) Tin and lead base, medium and small die castings.
(b) Primarily bearings and bushings.
(c) Complete facilities.

Franklin Die Casting Mfrs. Inc., 2535 Greenview Ave., Chicago.
(a) Zinc alloy die castings from 2-12 in.
(b) Automotive parts.
(c) Complete facilities.

H

Hoover Co., The, Maple and McKinley Sts., North Canton, O.
(a) Aluminum and zinc die castings, to 24 in. square.
(b) To customers' specifications.
(c) Complete facilities.

I

Imperial Die Casting Co., The, 2850 W. Fulton St., Chicago.
(a) Zinc and aluminum castings from 2 lbs. in aluminum, to 12 lbs. in zinc.
(b) Automotive, electrical and household machine parts.
(c) Complete facilities.

L

Latrobe Die Casting Co., Latrobe, Pa.
(a) Aluminum, zinc, tin and lead alloy die castings.
(b) Automotive, radio, office, household appliances, etc.
(c) Complete facilities.

Los Angeles Die Casting Co., 340 Crocker St., Los Angeles.
(a) Zinc base, yellow brass and aluminum die castings from ½ oz. to 15 lbs.
(b) To customers' specifications.
(c) Complete facilities.

M

Madison-Kipp Corp., 201 Waubesa St., Madison, Wis.
(a) Zinc, aluminum, magnesium, and brass die castings, all sizes.
(b) Automotive, household appliance, railway, etc.
(c) Complete facilities.

McGill Mfg. Co., Metal Division, Valparaiso, Ind.
(a) Aluminum bronze, and special hard bronze die castings from ½ oz. to 4 lbs.
(b) Gears, levers and other corrosion resistant machine parts.
(c) Complete facilities.

Michigan Die Casting Co., 11831 Charlevoix Ave., Detroit.
(a) Zinc base die castings in all sizes.
(b) Any type of machine part.
(c) Machining and finishing facilities.

Milwaukee Die Casting Co., 1015 N. Fourth St., Milwaukee.
(a) Lead-tin die castings to 14 lbs., zinc to 5 lbs.
(b) Motor cases, electrical apparatus, business machine, washing machine, etc.
(c) Machining and finishing facilities.

N

National Lock Co., 1902 Seventh St., Rockford, Ill.
(a) Zinc die castings to 12 in.
(b) To customers' specifications.
(c) Complete facilities.

New Products Corp., Willow Drive, Benton Harbor, Mich.
(a) Zinc die castings to 20 lbs., brass to 2 lbs., also aluminum.
(b) Household appliances, automotive, etc.
(c) Machining and assembling facilities.

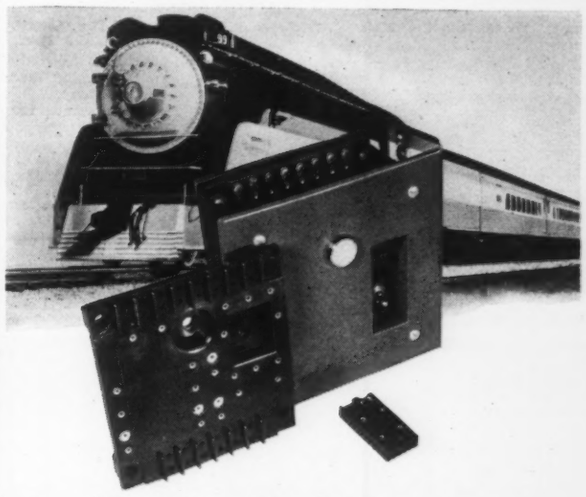
Newton-New Haven Co., 683 Third Ave., West Haven, Conn.
(a) Zinc base and high pressure aluminum die castings to 3 lbs.
(b) Aviation parts.
(c) Finishing facilities only.

EASY TO PICK THE *correct* S. A. E. FELT

● THIS HANDY NEW Sample Chart holds samples of all S. A. E. felt types . . . Shows S. A. E. specification tables . . . Classifies applications conveniently. ● All bound into standard size file-folder. Mailed free to any felt user. No obligation; no sales follow-up. C1212

Booth

BOOTH FELT COMPANY, INC.
444 19th STREET BROOKLYN, N. Y.

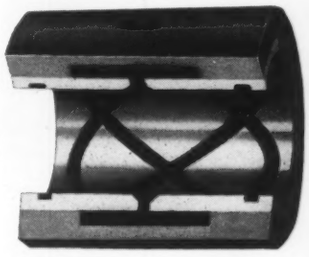


When Traveling Via Pullman your comfort is assured, for each Pullman room accommodation is equipped with an Individual Temperature Control Unit, which insures correct functioning of the cooling and heating equipment. The Individual Temperature Control Unit is a product of the Vapor Car Heating Company, 1600 So. Kilbourn Ave., Chicago, Illinois, and to insure proper insulation of its electrical parts, to effect economies in assembly costs and conserve space, the circuit breaker and base are molded of Bakelite by Chicago Molded Products Corporation.

Another example of good engineering design brought about by the co-operation of our Engineering Staff and the manufacturer. Our Engineering Department is ready to co-operate with you on your specific problem.

CHICAGO MOLDED PRODUCTS
corporation
1028 North Kolmar Avenue Chicago, Illinois

This Bushing Assembly



Randall bushing pressed into housing. Note cast or machined reservoir, tap for oil cup, and graphite feed plugs and graphite - filled grooves for distributing lubrication.

has solved many bearing problems

Randall Oil Reservoir Graphite Bronze Bushings can be incorporated into your old or new machine design without expensive changes or special tools. You will quickly benefit by using Randall Bushings as they have 300% to 400% longer life, they eliminate overheating and they will not seize or score the shaft.
Our engineers are ever ready to cooperate with your designing departments to obtain the utmost in bearing efficiency. Write for complete information and catalog of standard types and sizes.

RANDALL GRAPHITE PRODUCTS CORP.
609 W. Lake St., Dept. 1017, Chicago

Felt...

WESTERN FELT for

Sealing Bearings	Filtering Liquids
Conveying Lubricants	Sound Deadening
Vibration Absorption	Heat Insulating

Pioneers in seals and packing made of synthetic rubber.

If you are interested in FELT for the above or any problem involving the use of FELT, our forty years of experience in manufacturing and cutting FELT is at your disposal.

Advise us the purpose you have in mind and we will mail samples for that specific use.

WESTERN FELT WORKS
4037-4117 Ogden Ave., Chicago, Illinois
BRANCH OFFICES IN ALL PRINCIPAL CITIES

P

Paragon Die Casting Co., 5851 W. Dickens Ave., Chicago.
(a) Zinc die castings to 10 lbs., aluminum to 5 lbs.
(b) Auto, radio, refrigerator, food mixer, washing machine, etc.
(c) Machining and plating facilities.

Parker White Metal & Machine Co., McKinley Ave., at 23rd St., Erie, Pa.
(a) Zinc base die castings in any size.
(b) All types of machine parts.
(c) Complete facilities.

Phoenix Die Casting Co., 21 Illinois St., Buffalo.
(a) Aluminum, tin and zinc alloy die castings to 8 lbs., max.
(b) Radio, business machine and electrical parts.
(c) None.

Precision Castings Co. Inc., Fayetteville, N. Y. (Branch, Cleveland, O.; Die Shop, Syracuse, N. Y.)
(a) Aluminum and zinc castings from fraction of ounce to 26 lbs.
(b) Automotive, household appliances, outboard motors, etc.
(c) Machining, assembling facilities.

Precision Castings Co. Inc., Syracuse, N. Y. (also Cleveland).
(a) Zinc and aluminum die castings, large or small.
(b) To customers' specifications.
(c) Machining and finishing facilities.

Pressure Castings Inc., 21500 St. Clair Ave., Cleveland.
(a) Zinc and aluminum alloy die castings to 24 x 24 in.
(b) To customers' specifications.
(c) Finishing and machining facilities.

R

Rupert Die Casting & Stamping Corp., 1655 Cleveland Ave., Kansas City, Mo.
(a) Zinc alloy die castings.
(b) Washing machine, electrical and automotive parts.
(c) Complete facilities.

S

Schultz Die Casting Co., 1810 Clinton St., Toledo, O.
(a) Zinc base die castings.
(b) Automotive, etc.
(c) Machining and finishing facilities.

Stewart Die Casting Corp., 4535 Fullerton Ave., Chicago.
(a) Zinc and aluminum castings to 20 lbs.
(b) To customers' specifications.
(c) Finishing facilities.

Superior Die Casting Co., 17325 Euclid Ave., Cleveland.
(a) Zinc and aluminum alloy die castings.
(b) Dials, pulleys, bearing retainers, slingers, seals, levers, pump parts, etc.
(c) Machining facilities.

T

Titan Metal Mfg. Co., Bellefonte, Pa.
(a) Copper, zinc, lead, tin, nickel, manganese die castings to 2 lbs.
(b) Typewriter, electrical, airbrake, etc.
(c) Machining and assembling facilities.

Toman, E., & Co., 2621 W. 21st place, Chicago.
(a) All types of zinc base die castings from ½ oz. to 4 lbs.
(b) To customers' specifications.
(c) Complete facilities.

U

Union Die Casting Co. Ltd., 2313 E. 51st St., Los Angeles.
(a) All kinds of zinc alloy die castings.
(b) Vending, automotive, lubricating equipment, etc.
(c) Complete facilities.

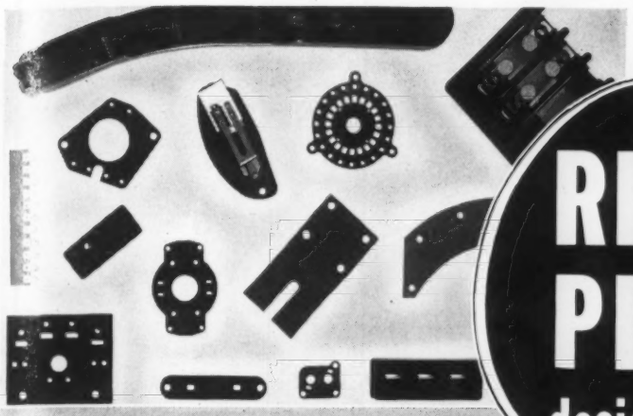
Universal Bearing Co., 639 Broadway, Lorain, O.
(a) Universal bearing metal die castings from few oz. to 30 or 40 lbs.
(b) Bearings.
(c) Information not available.

V

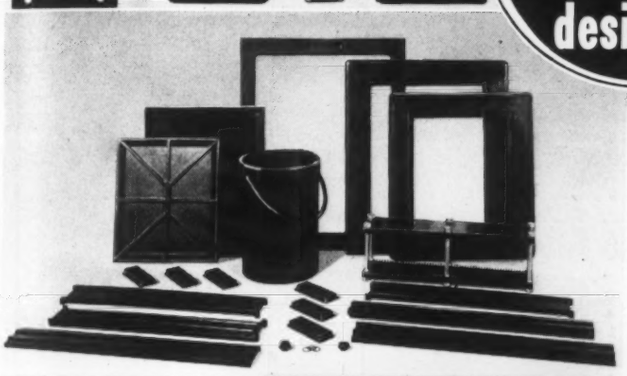
Veeder-Root Inc., Hartford, Conn.
(a) Precision die castings.
(b) To customers' specifications.
(c) Complete facilities.

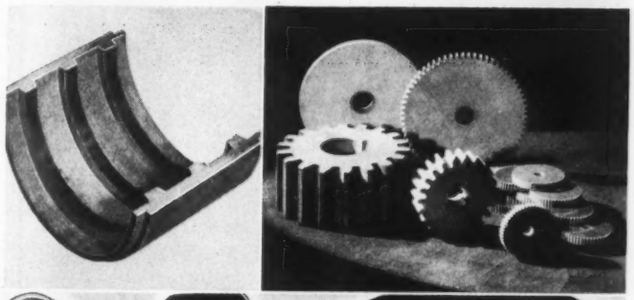
W

Western Die Casting Co., 4065 Hollis St., Oakland, Calif.
(a) Die castings of all alloys to 18 lbs.
(b) Flow meters, washing machine parts, oil filters, etc.
(c) Complete facilities.



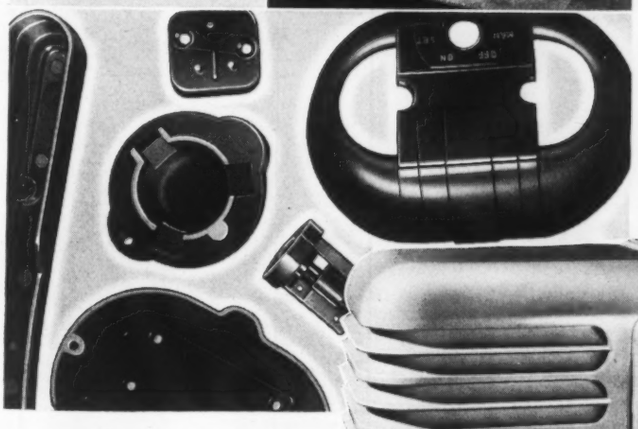
RICHARDSON PLASTICS for master designers and product engineers





Unbelievably diversified are the uses of Richardson plastics by engineers and designers in countless products and manufacturing equipment. In steel, paper, textiles, foods, ink, chemicals, printing, transportation, paint, floor coverings, electrical, communications, automotive and other industries, Richardson plastics are giving outstanding service, and suggesting further uses for these versatile materials. Consult Richardson engineers about any plastics application you have under consideration.

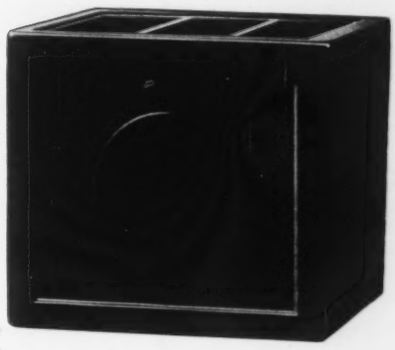
INSUROK, the superior plastic, is available in sheets, rods and tubes, in many grades, sizes, thicknesses and finishes for fabrication in your own plant—or completely finished parts ready for assembly. Tough, durable, strong, light in weight. Highly dielectric. For gears and bearings and other production equipment, INSUROK offers many profitable advantages. Get the facts about Laminated and Molded INSUROK. Write for complete details.



Radio by Belmont Radio Corp.

RUB-TEX

Molded hard rubber for electrical insulation, acid handling equipment and numerous other industrial applications.



EBROK

Widely used bituminous plastic for battery cases. Acid-resisting. Highly dielectric. Durable. Long-wearing.

The RICHARDSON COMPANY

Melrose Park, (Chicago) Ill. Founded 1858 Lockland, (Cincinnati) Ohio
New Brunswick, N. J. Indianapolis, Ind.
Detroit Office: 4-252 G. M. Building, Phone Madison 9386
New York Office: 75 West Street, Phone Whitehall 4-4487

Custom Molders of Plastics

Reference letters beneath addresses of companies refer to: (a) Types of materials utilized; and (b) Names of machine parts customarily molded.

A

Accurate Molding Corp., 116 Nassau St., Brooklyn.
(a) BAKELITE, DUREZ, RESINOX, BEETLE, PLASKON, LUMARITH, MASURON, TENITE, POLYSTYRENE.
(b) Electrical power conductors and insulators, housings, permanent wave machine parts.

Ackerman Rubber & Plastic Molding Co., 986 E. 200th St., Cleveland.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE THIOKOL.
(b) Mechanical, electrical and industrial.

American Insulator Corp., New Freedom, Pa.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, LUMARITH, TENITE, PLASTACELE, LUCITE and cold-molded composition.
(b) Knobs, buttons, balls, dials and handles.

American Molding Co., 16th and Vermont Streets, San Francisco.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUMARITH, PLASTACELE, LUCITE, POLYSTYRENE.
(b) Technical, and automotive, etc.

American Phenolic Corp., 1250 W. Van Buren St., Chicago.
a) BAKELITE, DUREZ, AMPHENOL, TENITE, SUNEX.
b) Electrical small sections, special rods and tubes.

American Products Mfg. Co., 8127-33 Oleander St., New Orleans.
(a) TENITE, PLASTACELE, and LUMARITH.
(b) Miscellaneous small parts not exceeding 4 oz.

Armstrong Cork Co., Industrial Div., Lancaster, Pa.
(a) CORPRENE.
(b) Gaskets, valve disks, cup packings, bushings, rolls, strips, etc.

Atlantic Plastic & Metal Parts Co., 2730 Grand Ave., Cleveland.
(a) BAKELITE, BEETLE, PLASKON, DUREZ, RESINOX, TENITE, LUCITE, PLASTACELE, LUMARITH, THIOKOL and other synthetics.
(b) Safety supply parts, lighting and electrical, radio, chemical, mechanical, etc.

Auburn Button Works Inc., Auburn, N. Y.
(a) BAKELITE, DUREZ, RESINOX, BEETLE, PLASKON, TENITE, LUCITE.
(b) All types of machine parts.

See advertisement, Page 55-D

B

Belmont Plastics Inc., 400 Pike St., Cincinnati.
(a) PLASTACELE, TENITE, LUMARITH, FIBERLON.
(b) All types of injection molded machine parts.

Berkander Inc., George F., 891 Broad St., Providence, R. I.
(a) TENITE, LUMARITH, PLASTACELE.
(b) To customers' specifications.

Boonton Molding Co., 326 Myrtle Ave., Boonton, N. J.
(a) BAKELITE, DUREZ, RESINOX, TENITE, PLASTACELE, LUCITE, CRYSTALITE, STYRON, POLYSTYRENE, PLASKON, BEETLE.
(b) To customers' specifications.

Bridgeport Moulded Products Inc., Bridgeport, Conn.
(a) BAKELITE, DUREZ, PLASKON, TENITE, LUCITE, LUMARITH, CRYSTALITE, PLASTACELE, MONSANTO, POLYSTYRENE, BEETLE, MAKALOT, RESINOX.
(b) To customers' specifications.

Bright Plastics Inc., 350 Huffman Ave., Dayton, O.
(a) Compound special molding materials.
(b) All types of injection molded machine parts.

Butterfield Inc., T. F., 56 Rubber Ave., Naugatuck, Conn.
(a) BAKELITE, DUREZ, MAKALOT, BEETLE, PLASKON, TENITE, LUMARITH, LUCITE, etc.
(b) Radio, heater switch, electrical, etc.

C

Cardinal Corp., Evansville, Ind.
(a) Any thermoplastic material.
(b) Specially finished injection moldings.

Chicago Die Mold Mfg. Co., 1735 W. Diversey Parkway, Chicago.
(a) TENITE, BAKELITE, PLASKON, LUCITE, STYRON, etc.
(b) To customers' specifications.

Chicago Molded Products Corp., 1028 N. Kolmar Ave., Chicago.
(a) BAKELITE, DUREZ, RESINOX, PLASKON, BEETLE, TENITE, LUMARITH, PLASTACELE, LUCITE, POLYSTYRENE.
(b) Automotive, industrial, mechanical, scientific, surgical, electrical.

See advertisement, Page 57 D

Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
(a) All plastic materials.
(b) All types of machine parts.

Columbus Plastic Products Inc., 519 Dublin Ave., Columbus, O.
(a) LUMARITH, PLASTACELE, FIBESTOS, etc.
(b) Knobs, plates, small housings, etc.

Commonwealth Plastic Co., Leominster, Mass.
(a) TENITE, LUMARITH, PLASTACELE, LUCITE, POLYSTYRENE.
(b) Radio knobs and escutcheons, remote control cases, automotive, hardware, etc.

Consolidated Molded Products Corp., Scranton, Pa.
(a) BAKELITE, DUREZ, TENITE, LUMARITH, LUCITE, CRYSTALITE, POLYSTYRENE, PLASKON, BEETLE, LACANITE.
(b) Knobs, handles, wheels, terminal bases, bushings, cases, switches, etc.

Continental-Diamond Fibre Co., Newark, Del.
(a) CELORON, DILECTO.
(b) Gears, couplings, aircraft parts, etc.

Cutler-Hammer Inc., 315 N. 12th St., Milwaukee.
(a) THERMOPLAX, PYROPLAX.
(b) Terminal blocks, insulators, switch bases, knobs, handles, insulating bushings, arc shields and miscellaneous electrical insulating forms.

D

Diemolding Corp., Canastota, N. Y.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, TENITE or any other plastics of similar nature.
(b) Control handles or knobs, small bases and plates, housings, etc.

E

Eclipse Moulded Products Co., Milwaukee.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, LUMARITH, LUCITE, TENITE, RESINOX.
(b) Valve handles, insulator parts, housings, transparent casings, knobs, switch buttons, control covers, cams and pulleys.

Emeloid Co. Inc., The, 287 Lauri Ave., Arlington, N. J.
(a) TENITE LUCITE, PLASTACELE, LUMARITH, POLYSTYRENE.
(b) Small parts weighing 2 oz. or less.

Erie Resistor Corp., 640 W. 12th St., Erie, Pa.
(a) TENITE, LUMARITH, LUCITE, STYRENE, PLASTACELE.
(b) Radio, refrigerator, automotive, handles, knobs, etc.

F

Firestone Tire & Rubber Co., The, Akron, O.
(a) Styrene and all types of molding materials including phenolic, urea, cellulose acetate and butyrate, methylmethacrylate.
(b) Textile bobbins, milking machine cups, automotive parts, electrical parts, housings, insulators, and switchboard parts.

G

Gemloid Corp., 7910 Albion Ave., Elmhurst, L. I., N. Y.
(a) POLYSTYRENE, VINYLITE, cellulose acetate and nitrate, methyl-methacrylate, and any material in sheet form or crystal molding powder.
(b) To customers' specifications.

General Electric Co., Plastics Dept., 1 Plastics Ave., Pittsfield, Mass.
(a) TEXTOLITE (molded, laminated and cold-molded).
(b) All types to customers' requirements.

General Industries Co., International Insulating Div., Elyria, O.
(a) BAKELITE, DUREZ, RESINOX, PLASKON, BEETLE, TENITE, LUMARITH, PLASTACELE, LUCITE, CRYSTALLITE.
(b) Special parts to customers' specifications.

General Insulate Co. Inc., 11 New York Ave., Brooklyn.
(a) INSULATE, ureas, acetates, phenolics, acrylates.
(b) Insulators and insulating parts according to specification.

Gits Molding Corp., 4600 W. Huron St., Chicago.
(a) TENITE, LUMARITH, PLASTACELE, MASURON, LUCITE, BAKELITE, POLYSTYRENE.
(b) Radio knobs and cabinets, push-buttons, escutcheons, dials, supports and insulators.

Gorham Co., Plastics Div., Elmwood Station, Providence, R. I.
(a) BAKELITE, DUREZ, RESINOX, MAKALOT, BEETLE, PLASKON, LUCITE, TENITE, PLASTACELE, LUMARITH, MONSANTO.
(b) All types to customers' specifications.

Grigoleit Co., The, 740 E. North St., Decatur, Ill.
(a) BAKELITE, DUREZ, INDUR, RESINOX, PLASKON, BEETLE.
(b) Molded composition, knobs, handles and caps.

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OCTOBER, 1939

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A New Material for Better Products!

Seldom a new material possesses so many desirable characteristics as MORGANITE.

Now satisfactorily used as water and oil pump seals, valves, bearings and many other industrial applications.

★ Requires no lubricant.

★ Does not seep oil to spoil products in process.

★ Unaffected by temperatures up to 800°F.

★ Unaffected by most acids and alkalis.

The use of MORGANITE can improve your product. Why not send the details to our Engineering Department today.

MORGANITE BRUSH CO., Inc.
Long Island City • New York

MORGANITE

H

Haveg Corp., Newark, Del.
(a) HAVEG.
(b) Acid-resistant equipment, standard tanks, piping, fittings, fume duct, towers, etc.

Hyde, A. L., Grenloch, N. J.
(a) BAKELITE, RESINOX, TENITE, PLASTACELE.
(b) All types of pressure and injection molded machine parts.

I

Imperial Molded Products Corp., 2925 W. Harrison St., Chicago.
(a) BAKELITE, PLASKON, DUREZ, BEETLE, TENITE.
(b) All type of compression molded parts.

Insulation Mfg. Co. Inc., 11 New York Ave., Brooklyn.
(a) Acetates, phenolics, acrylates and Electros.
(b) Insulators and insulating parts.

Insulation Products Co., 504 North Richland St., Pittsburgh.
(a) BAKELITE, DUREZ, TENITE, PLASKON.
(b) Parts to customers' specifications.

International Molded Plastics Inc., 4384 W. 35th St., Cleveland.
(a) PLASKON, BEETLE, DUREZ, TENITE, LUCITE, BAKELITE.
(b) All types of machine parts, specializing in large moldings.

K

Keolyn Plastics Co., 2731 N. Pulaski Rd., Chicago.
(a) PLASTACELE, TENITE, LUMARITH and other thermoplastics for injection molding.
(b) Knobs, handles, housings and special parts.

Keystone Specialty Co., 1373½ Cove Ave., Lakewood, O.
(a) Any material to customers' specifications.
(b) Parts to customers' specifications.

Kuhn & Jacob Moulding & Tool Co., 1200 Southard St., Trenton, N. J.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUCITE, LUMARITH, etc.
(b) Compression molding of electrical, automotive, radio, airplane, instrument, permanent wave machine parts, etc.

Kurz-Kasch Inc., 1415 S. Broadway, Dayton, O.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, LUMARITH, TENITE, CRYSTALITE, LUCITE.
(b) Shift balls, general insulating parts, both mechanical and electrical.

L

Lanfare Molded Products, 1519 Freeman St., Toledo, O.
(a) PLASKON, DUREZ, MAKALOT.
(b) Electrical instrument cases, radio, etc.

M

Mack Molding Co. Inc., Ryerson Ave., Wayne, N. J.
(a) BAKELITE, DUREZ, TENITE, BEETLE, LUMARITH, FIBESTOS, PLASKON.
(b) Parts to customers' specifications.

Meissner Mfg. Co., Mt. Carmel, Ill.
(a) Any phenolic or thermosetting materials.
(b) Insulators, handles, bushings, gears, bearings, etc.

Midwest Molding & Mfg. Co., 319 North Whipple St., Chicago.
(a) BAKELITE, DUREZ, BEETLEWARE, PLASKON and other thermosetting compounds.
(b) All types of machine parts.

Molded Insulation Co., 335 E. Price St., Philadelphia.
(a) BAKELITE, DUREZ, RESINOX, DURITE, BEETLE, PLASKON, TENITE, LUCITE.
(b) Aircraft, radio, electrical and other machine parts.

N

National Lock Co., Rockford, Ill.
(a) BAKELITE, BEETLE, PLASKON, DUREZ, TENITE.
(b) Handles, pulls, stove and refrigerator trim.

Norris Co., The, Paul A., 101 W. Second St., Wellston, O.
(a) TENITE, FIBESTOS, LUMARITH, PLASTACELE and all acetate molding materials.
(b) Housings for machinery, handles, knobs, etc.

Northern Industrial Chemical Co., 7 Elkins St., South Boston, Mass.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUMARITH, etc.
(b) Any molded part to customers specifications.

Norton Laboratories Inc., 520 Mill St., Lockport, N. Y.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, TENITE, LUMARITH, LUCITE, PLASTACELE, FIBERLOID.
(b) Housings, terminals, bushings, wheels, knobs, handles, etc.

P

Plano Molding Co., 113 South Center Ave., Plano, Ill.
(a) BAKELITE and other phenolics, BEETLE and other ureas, TENITE and cellulose acetates or similar material.
(b) To customers' specifications.

Potter & Brumfield Mfg. Co. Inc., Princeton, Ind.
(a) RESINOX, DUREZ and other thermosetting plastics.
(b) Small parts, terminal boards, cams, etc.

R

Recto Molded Products Inc., Appleton and B. & O. R. R., Oakley, Cincinnati.
(a) DUREZ, BAKELITE, TENITE, LUMARITH, RESINOX, PLASKON.
(b) All types to customers' specifications.

Reinhold, F. E., 7001 McKinley Ave., Los Angeles.
(a) BAKELITE, BEETLE.
(b) Electrical parts, radio cabinets, etc.

Reynolds Molded Plastics Div. Reynolds Spring Co., Jackson, Mich.
(a) BAKELITE, PLASKON, TENITE, LUMARITH, BEETLE, DUREZ, LUCITE.
(b) All types to customers' specifications.

Richardson Co., The, 27th and Lake Sts., Melrose Park, Chicago.
(a) INSUROK, EBROK, RUB-TEX.
(b) All types to customers' specifications.
See advertisement, Page 59-D

Royal Moulding Co., 69 Gordon Ave., Providence, R. I.
(a) BAKELITE, RESINOX, DUREZ, PLASKON, BEETLE, MAKALOT.
(b) Electrical appliance housings.

S

Sheller Mfg. Co., Portland, Ind.
(a) TENITE, LUMARITH, PLASTACELE, RESINOX, BAKELITE, and miscellaneous plastics.
(b) Automotive and miscellaneous.

Sinko Tool & Mfg. Co., 351 N. Crawford Ave., Chicago.
(a) TENITE Nos. 1 and 2, POLYSTYRENE, LUMARITH, PLASTACELE, FIBRELOID, LUCITE, CRYSTALITE.
(b) Radio and automotive knobs, pushbuttons, escutcheons, bezels, etc.

Specialty Insulation Mfg. Co. Inc., Hoosick Falls, N. Y.
(a) COLASTA, BAKELITE, DUREZ, TENITE, BEETLE, PLASKON, etc.
(b) Business machines parts, etc.

Stokes Rubber Co., Jos., Taylor and Webster Sts., Trenton, N. J.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, LUMARITH, TENITE.
(b) All types to customers' specifications.

T

Tech-Art Plastics Co., 41-01 Thirty-sixth Ave., Long Island City, N. Y.
(a) BAKELITE, RESINOX, MAKALOT, DUREZ, BEETLE, TENITE, LUCITE.
(b) All types to customers' specifications.

Terkelsen Machine Co., 326 A St., Boston.
(a) BAKELITE, DUREZ, INDUR, MAKALOT, PLASKON, BEETLE.
(b) All types to customers' specifications.

Ther Electric & Machine Works, 17 S. Jefferson St., Chicago.
(a) DUREZ, BAKELITE, PLASKON, etc.
(b) To customers' specifications.

Thermo-Plastics Div. of The Standard Products Co., St. Clair, Mich.
(a) BAKELITE, ETHOCEL, FIBESTOS, HERCULES, LUMARITH, MASURON, PLASTACELE, POLYSTYRENE, TENITE, VINYLITE.
(b) Business machine parts, knobs, handles, clock cases, instrument panels, radio cabinets, scale bases, steering wheels, as well as all smaller applications.

U

Union Insulating Co., Box 351, Parkersburg, W. Va.
(a) BAKELITE, PLASKON, DUREZ.
(b) Any type to customers' specifications.

V

Van Norman Molding Co., 6437 S. State St., Chicago.
(a) BAKELITE, DUREZ, PLASKON.
(b) Knobs, handles and insulating parts.

Victor Metal Products Corp., 196 Diamond St., Brooklyn.
(a) BAKELITE, RESINOX, DUREZ, PLASKON, BEETLE.
(b) Small parts not over 3 in. in dia.

W

Ward Plastic & Rubber Co., 1037 Hilton Rd., Ferndale, Mich.
(a) All thermoplastic and thermosetting materials.
(b) Condulet boxes, coil bobbins, bearings, handles, oil seals, pump parts such as washers, seals, stators, various electrical parts etc.

Waterbury Button Co., The, 39 River St., Waterbury, Conn.
(a) BAKELITE, DUREZ, BEETLE, PLASKON, TENITE, LUCITE, SHELLAC COMPOSITION, LUMARITH, RESINOX, CRYSTALLITE, etc.
(b) All types to customers' specifications.

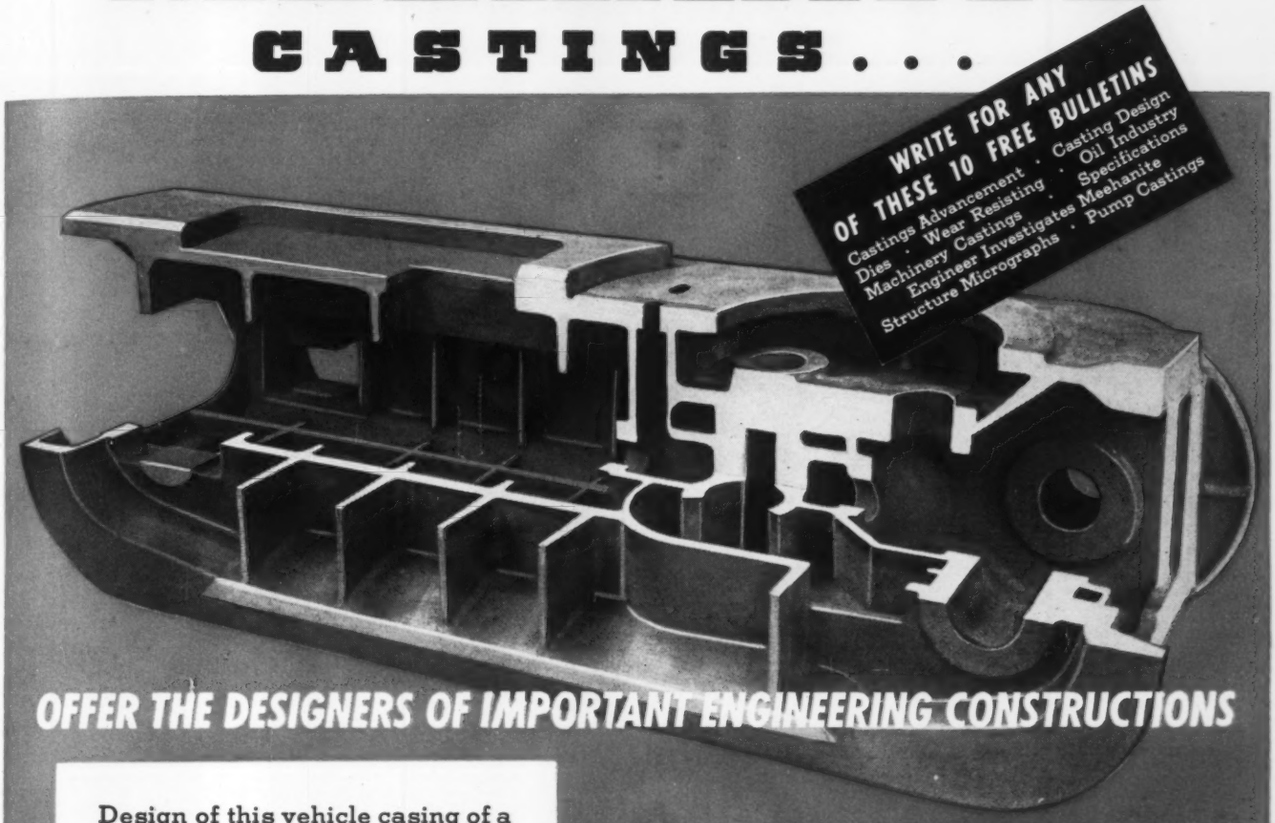
Watertown Mfg. Co., Echo Lake Rd., Watertown, Conn.
(a) NEILLITE, BAKELITE, DUREZ, RESINOX, TENITE, LUMARITH, FIBESTOS, PLASTACELE, LUCITE, BEETLE, PLASKON.
(b) Contact blocks, insulator blocks, switch housings, cams, spacers and any other moldable parts.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
(a) MICARTA.
(b) To customers' specifications.

Windman Brothers, 3325 Union Pacific Ave., Los Angeles.
(a) BAKELITE, DUREZ, PLASKON, BEETLE, all phenolics and ureas; STEARINES, acrylic resins and TENITE or cellulose acetates.
(b) Electric razor cases, radio cabinets, electrical, mechanical, dental, photographic and surgical equipment parts.

MEEHANITE

CASTINGS . . .


WRITE FOR ANY
OF THESE 10 FREE BULLETINS
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OFFER THE DESIGNERS OF IMPORTANT ENGINEERING CONSTRUCTIONS

Design of this vehicle casing of a mining machine required extreme changes in section thickness and unusual strength. Cast in *Meehanite Metal,* tested and examined, the casting was found to be free from defects,—had a tensile strength of 59,400 p. s. i.

- *Uniform* solidity and density throughout all sections.
- *Freedom* from Internal Strains and Local Planes of Weakness.
- *Free* Machining.
- *Predetermined* Dependable Engineering Properties.

MEEHANITE METAL CORPORATION

Pittsburgh, Pa.

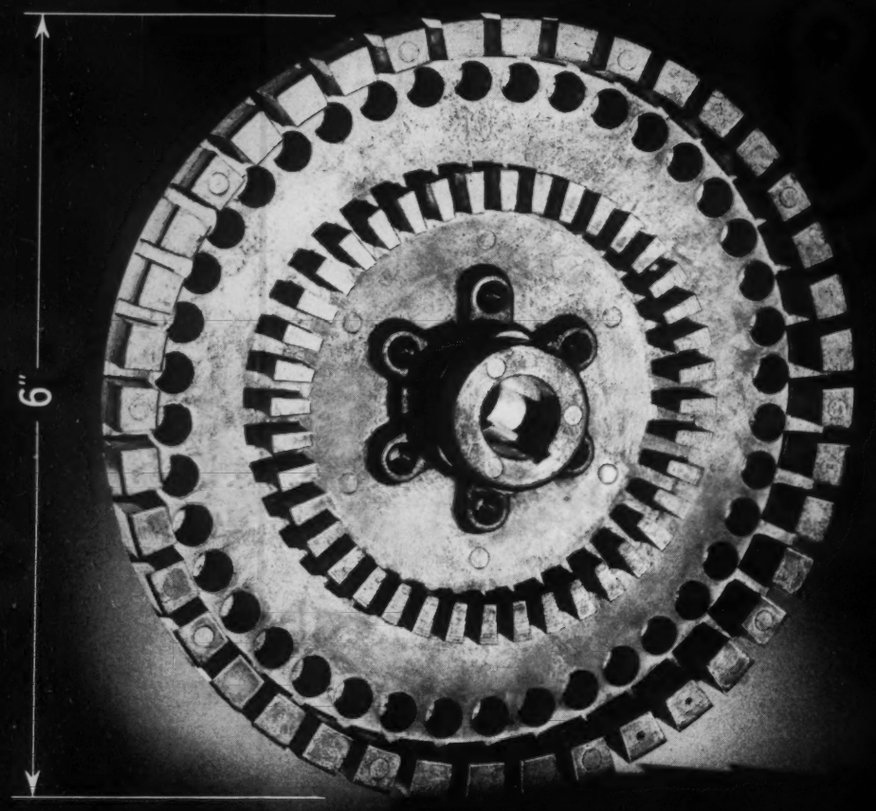
The International Meehanite Metal Co., Ltd.
London, England

Australian Meehanite Metal Co.
Waterloo, N. S. W., Australia

South African Meehanite Metal Co. (Pty.) Ltd.
Johannesburg, South Africa

See listing of licensed manufacturers on page 26-D

ZINC ALLOY DIE CASTINGS



$11.30 SAVED
—By Die Casting This Part

When a well-known coin stamping machine was redesigned recently, the above part—the heart of the machine—was changed to a ZINC Alloy Die Casting. The saving in piece cost over the former "machined" part was $11.30. Consider *all* of the following features of this part as a die casting.

1. ECONOMY—There is no machining required on this casting other than the removal of the gate and tapping of the cored holes. The part illustrated here has received no further machine work. Here is rare complexity of design cast *in one piece.*

2. ACCURACY—The mechanism of the coin stamping machine is such that exceptionally close tolerances are demanded of this part. As a ZINC Alloy Die Casting, dimensions as close as .001" are held—and these dimensions will be the same in the first and last casting of a long production run.

3. STRENGTH—The strength of this casting is superior to that of the former part, yet there is a decided saving in weight. The smaller, rear view photograph shows the elimination of metal by the use of strengthening ribs.

This is not an unusual instance of die casting economy—hundreds of other manufacturers can cite similar savings in their products through the use of die cast parts. Consult any commercial die caster about ZINC Alloy Die Castings—or write to this Company.

• This casting, and many others you should see, will be exhibited in our BOOTH—L-311—at the— NATIONAL METAL EXPOSITION International Amphitheatre CHICAGO—OCT. 23-27

THE NEW JERSEY ZINC COMPANY
160 Front Street New York

The Research was done, the Alloys were developed, and most Die Castings are specified with

HORSE HEAD SPECIAL (99.99+% UNIFORM QUALITY) ZINC

Spotlight Is on Design Materials Due to War-Time Conditions

THE best forecast in the world could not predict with any degree of certainty the position of design materials in the next two or three years. With the steel ingot production rate throughout the country already at 84.5 per cent of capacity (practically a normal "top"), with nonferrous rolling mills working night and day, and with producers of plastics and other nonmetallic materials gearing up for intensive production, one thing is sure: The demand for the more widely used materials will shortly exceed the supply!

This is, of course, based on the assumption that the war in Europe will continue. It does not necessarily rest upon the lifting of the embargo on arms, however. Whichever course is adopted by congress on this matter there is still bound to be a generally increased rate of demand and production.

To be on the safe side it may well repay engineers responsible for design of machinery to take stock of this situation now. It probably will happen, for instance, that certain materials selected for designs in the layout or development stage will rise in price to a point that prohibits their economical use and thus make alternatives desirable. Better to consider such eventualities and to be prepared with suitable alternatives at the layout stage than to be embarrassed later. Any hitch in making an effective switchover to maintain machine production (already, incidentally, approaching a high peak in some of the machinery fields), would be disastrous from many aspects.

It is at such a time as this that intensive observation and study of materials is of paramount importance to the designer. Not only should contingencies such as the foregoing be considered, but also the normal substitution of one material for another—temporary or otherwise—as brought about by development and research should be taken into account. Radical as might have seemed the announcement some months ago that airplanes were being produced with fuselages of plastic molded material, even stranger things might come to pass in connection with planes needed in vast quantities for war-time purposes. Other developments and substitutions can only be surmised, but it is safe to say that if events continue as they now are going the need for knowledge and information on the use and selection of materials will increase drastically.

It is hoped that the current issue of M. D. and the Directory of Materials included therein will do their part in assisting the designer to meet the exigencies of the hectic days ahead.

All working parts are of heat-treated steel in the Micromatic Hydrohoner (left). Proportionate, continuous feed is maintained by an hydraulic piston, pressure for which is kept uniform by floating differential construction. Single movements of the operating hand lever start a synchronized cycle of actuations and return the table to loading position. Coolant pump and motor are driven by the hydraulic unit motor in the cast steel base

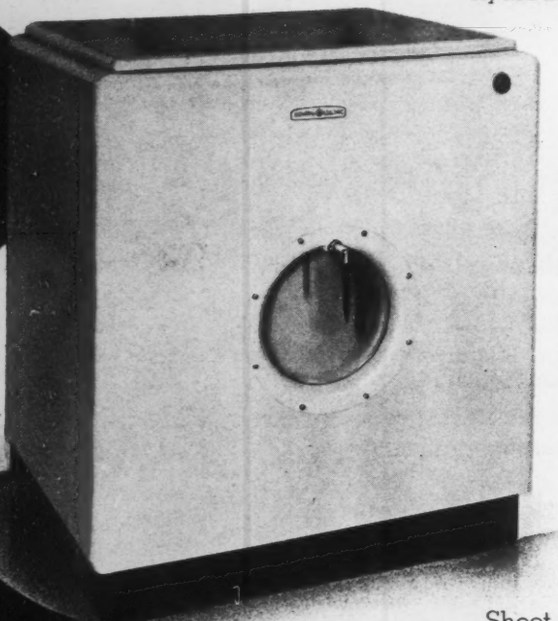
One-piece square frame of the Pü Hansen welder (above) is of welded allo steel. Only two major parts are in th machine, the frame and the rotatin member. The welder has been d signed specifically for easy adaptatio to single or double duty service. I stead of two or more separate welde producing separate arcs, one machi may be used by throwing a switch

Designe

In New a

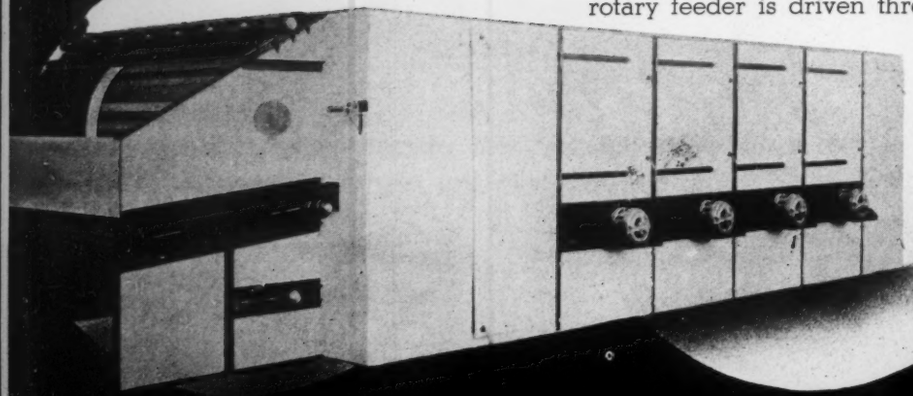
A Pictorial Present Re with Special Refere Cho

THIS MONTH'S COVER. Brillia luster is added to the Hobart fo slicer by its silvery finish of stainle steel and aluminum. A special knife also stainless. By means of a smoo gliding carrier plate, food to be slic actually rides to the knife witho bottom drag or cleaving to the platte The entire machine is styled in confor ity with current trends



Two coats of white baked enamel to resist rust and chipping cover the steel cabinet and top of the General Electric tumbler clothes dryer (left). Base is painted steel while the outer drum is galvanized sheet steel. A one-quarter-horsepower motor drives the cylinder, the other end of the shaft being connected to the centrifugal blower which forces draft through the bottom of the cabinet

Sheet steel on a fabricated steel frame comprises the housing of the Hunter rotary feeder and raw stock dryer (below). Bottom feed apron at left may be stainless steel. The rotary feeding cylinder is built on heavy cast iron spiders. Beater and comb blades are stainless steel. Motors shown are direct-connected to fans, obviating belts and pulleys. The rotary feeder is driven through a single horsepower motor



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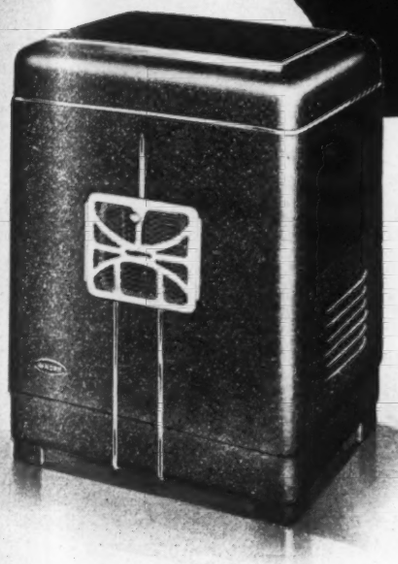
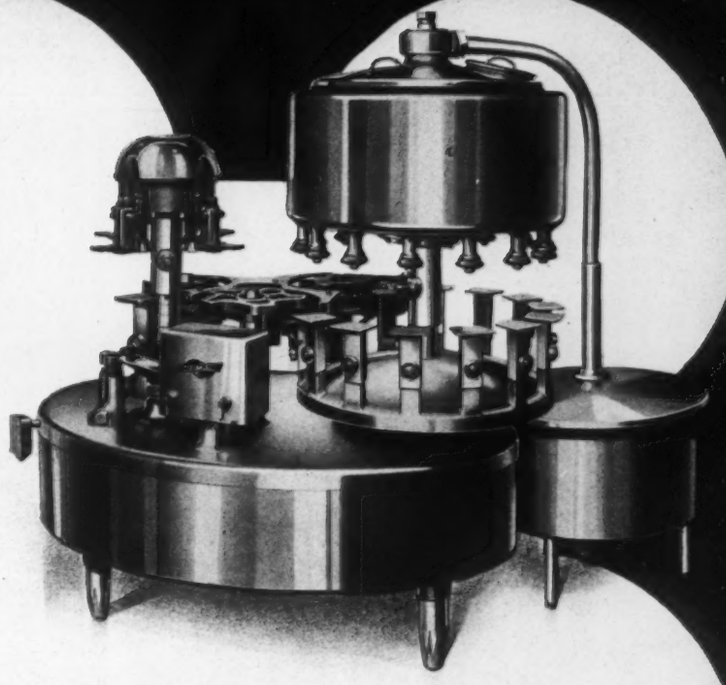
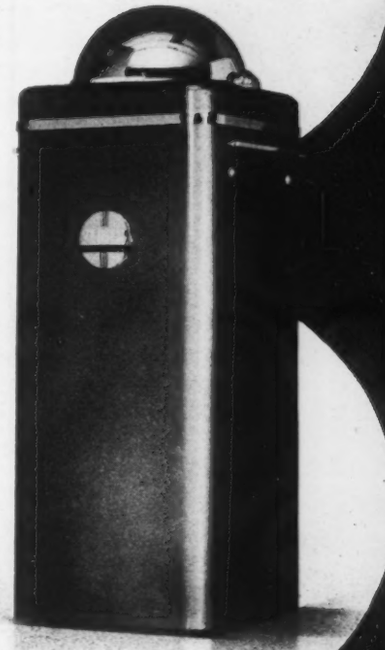
Recent Machinery
Choice of Materials



Vitrolain, a new finish comprising a glass fused on metal which resists chipping and also retains a high luster, has been introduced on the Renown oil heater (left). It requires no ground coat. A "no-draft" bottom is incorporated in the heater. The dual-chamber burner has a chromium steel bottom



Every exposed part of the Crown milk filler-capper (above) is either stainless steel or nickel silver, to maintain sanitation. The frame is solid welded stainless and no paint is used. Crevices and pockets have been eliminated. Main drive from the motor through the gear reduction unit and variable speed drive pulley is a combination of heat-treated, alloy steel spur gears and roller driving chain

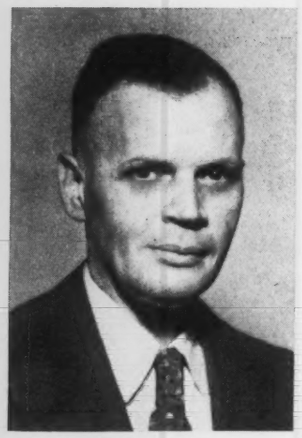


Plastics, chromium and stamped steel have been used to advantage in the Shelton permanent wave machine (right). The deep metallic gray cabinet is of steel with decorative nameplate and trim in chromium. Around the top of the cabinet is a chromium band which hides a joining point. Styled by Barnes & Reinecke, the machine has a plastic control panel concealed on the lower portion of the polished chromium ball when not in use

Cleanliness is a paramount consideration in the Anderson ice cream mold filler (left). All parts coming into contact with ice cream are either nickel silver or stainless steel, including the nickel silver hopper and float and the stainless steel pistons and nozzle plate. The large cylinder head casting is made from a stainless steel billet weighing about 650 pounds. All main working mechanisms are enclosed in the welded steel base

Complete covering of all mechanisms by a "cleanlined" exterior of cast alloy iron in the Landis hydraulic grinder (below) results in pleasant appearance, safety and freedom from dirt accumulation. Headstock face plate has a multiple V-belt drive from a constant speed motor; footstock spindle is hydraulically operated, as is the lateral locator. New spherical self-aligning bearings of babbitt lined steel and removable cartridge seats are used. Bearing clearance may be readily changed by a dial

Men of Machines



JOHN M. WALTER

AFTER fourteen years of service with The G. A. Gray Co., Cincinnati, John M. Walter has been named chief engineer of the company. Previous to becoming connected with this company, Mr. Walter obtained experience with other companies in various fields of design including automobiles, trucks, fire fighting equipment and machine tools. Beginning in the engineering department of the Gray company, Mr. Walter progressed rapidly serving successively as development engineer and assistant chief engineer, the position he occupied before his present appointment. In his connection with the Gray organization he has had responsible charge of the many designs which have been produced by the company during the last decade. He has to his credit a considerable number of important inventions introduced by the company recently.

W. J. ADAMS

COINCIDENT with the acquisition, by Gar Wood Industries Inc., Detroit, of the tractor equipment division of Continental Roll & Steel Foundry Co., W. J. Adams, original designer and patentee of the two-wheel Continental scraper, has been added to the engineering staff of the Road Machinery division of Gar Wood Industries Inc. The company has also acquired all of Mr. Adams' patents and designs of scrapers.

Mr. Adams began his career as a rancher absorbed with problems of properly grading and leveling land for irrigation. There he amassed a fund of valuable experience in the moving of earth with scraper equipment. During the past 15 years he has been actively engaged in the design and manufacture of earth-moving scrapers. In his connection with Continental Mr. Adams designed the widely used Continental scrapers.

H. H. MORGAN

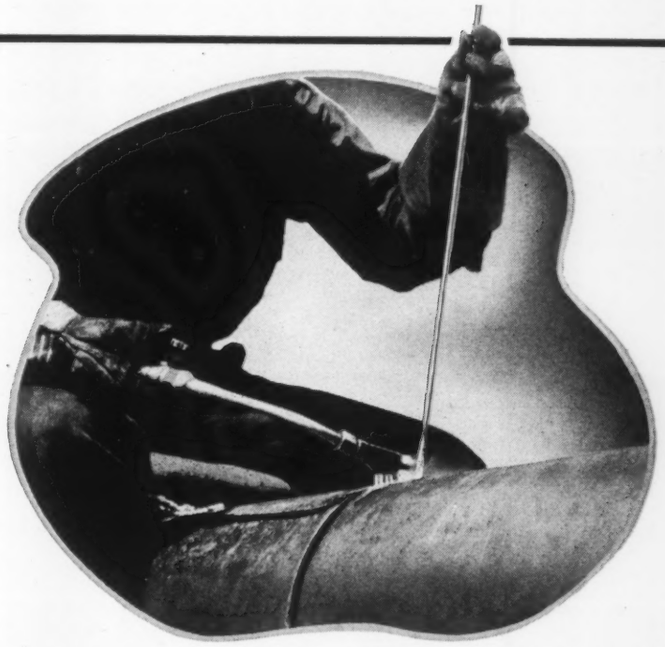
SINCE graduating from Lewis institute with a mechanical engineering degree, H. H. Morgan, recently named president of the American Society for Testing Materials, has been connected with testing, inspection and research problems in the field of materials. Mr. Morgan is associated with Robert W. Hunt Co. In 1907 he was in charge of miscellaneous inspection for this company and three years later became manager of its physical testing laboratories, serving in that capacity until 1917. During the World War period he represented his company on war materials inspection for the Engineer Corps, U. S. A., becoming Captain. For the next ten years he was manager of the company's Pittsburgh office and district. Since 1928 he has been in his present position in charge of activities involving inspection work for more than half the railroads in the United States. Mr. Morgan's activities in the American Society for Testing Materials in-

By helping its customers Linde Helps Itself

WHEN Linde products and processes "go into your plant" something equally important goes with them—Linde Process Service. This service is designed to help the customer use Linde products to do a better job. It works day-in and day-out to help find new ways to speed up production, make a better product, or cut costs.

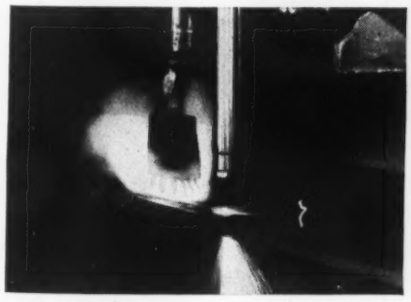
By helping its customers, Linde helps itself. To extend the profitable use of its products, Linde knows it must constantly help customers control process costs. That's why Linde customers feel that there's something more vital in their relations with Linde than just the price of the products used.

Linde Process Service takes many forms—all backed by a co-ordinated, nation-wide organization which includes an alert research staff. Whatever the form of service you require, you'll find it is geared to your individual needs. Any Linde man will tell you more about it. The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, Offices in principal cities.

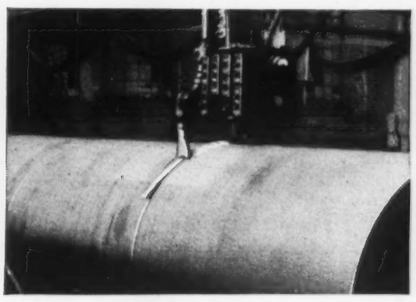


LINDEWELD MULTI-FLAME PROCESS—Strong and tough welds of uniformly high quality can be obtained when joining pipe or steel plate by this Linde process. It is extremely fast and consumes a minimum of oxygen and acetylene. Oxweld 6- and 4-flame tips, high-speed welding rod, and a special, easily-learned technique make the process possible. Linde service can help you use it to do a better job at lower cost.

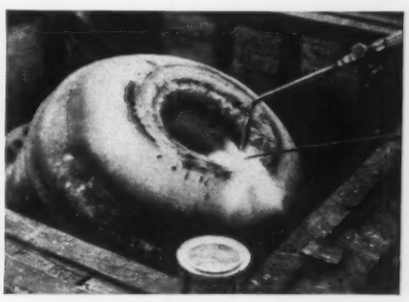
THERE IS MORE TO **Linde** *THAN "EVERYTHING FOR WELDING AND CUTTING"*



FLAME-SOFTENING—The same oxy-acetylene flame used to "flame-harden" metal parts, can be used to soften locally hardened areas resulting from flame-cutting, shearing, or welding of certain high-carbon or alloy steels.



UNIONMELT WELDING—A revolutionary, fully-automatic electric welding process—developed by Linde—with which one-pass welds of high quality can be made in any commercially used thickness of steel at amazing speeds.



BRONZE-WELDING — This widely used oxy-acetylene process provides a means of permanently bonding similar or dissimilar metals, without melting or seriously affecting them. It is also used to build up worn surfaces.

LINDE OXYGEN • NITROGEN • HYDROGEN • RARE GASES AND MIXTURES • UNION CARBIDE PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES • UNIONMELT WELDING

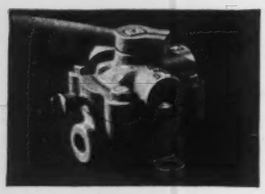
The words "Linde," "Union," "Prest-O-Lite," "Oxweld," "Lindeweld" and "Unionmelt" are trade-marks of Units of Union Carbide and Carbon Corporation.

Learn more about the Unionmelt welding process and other new processes and products developed by Linde, at Exhibit Areas L302 and M301, National Metal Exposition, International Amphitheatre, Chicago, October 23-27, 1939.

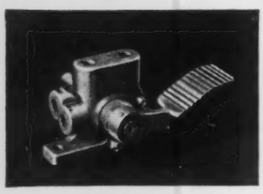
NOPAK VALVES for Every Air Control Problem

- Positive Control thru Finger-Touch operation
- Quick or Throttling Action as desired
- No Air Loss thru Valve Leakage
- No Valve Packing to Replace
- No Valve Maintenance or Service Costs.

...enable you to build these **SALES FEATURES** into your **MACHINES**



3 and 4-Way Hand Operated Valve



3 and 4-Way Foot Operated Valve with Spring "Return"

NOPAK Solenoid Valve, 3 and 4-Way, with Push Button Control

The NOPAK *packless principle* and *patented rotating disc construction* make these features *yours* at no extra cost. Air pressure against the valve disc, at all times, keeps lapped surfaces of disc and seat positively sealed, permits finger-touch operation, and prevents injury of sealing surfaces from grit or other foreign matter. The result is a leakproof valve with sealing surfaces that actually improve with use.

The packless, leakproof valve-stem assembly eliminates all packing replacements, gland-nut adjustments, maintenance or service requirements.

NOPAK Valves for Air or Hydraulic control are made in a wide range of standard sizes and models to meet practically all design applications. For detailed descriptions and technical data, write for Illustrated Valve Bulletin, No. 65.

NOPAK Air Cylinders

—are Cushioned Air Cylinders—with Adjustable Cushion-Heads for close regulation of cushion-effect . . . or with the new type Self-Regulating Cushion Head. The latter sell in the same price range as non-cushioned cylinders.

GALLAND-HENNING MFG. CO.

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NOPAK VALVES and CYLINDERS

clude being chairman of the Committee A-1 on Steel, and Tubing Materials committee, and a member of the ferro-alloys, and methods of testing committees. He is also chairman of a sectional committee on Standardization of Dimensions and Materials. Previous to his election as president, Mr. Morgan was vice president of the society.

♦

FREDERICK M. DARNER, formerly identified with Bucyrus-Erie Co. and Erie Malleable Iron Co., has been appointed assistant chief engineer of Republic Steel Corp., Cleveland.

♦

GEORGE W. JERNSTEDT, an engineer of Westinghouse Electric & Mfg. Co., Newark, N. J., has been awarded the Benjamin Garver Lamme graduate scholarship for 1939-40. Mr. Jernstedt, who has been connected with Westinghouse since 1936, will devote study to fundamentals of electroplating of copper and its alloys with beryllium.

♦

W. D. SIZER has been appointed executive engineer in charge of all engineering activities at the Harrison plant of Worthington Pump & Machinery Corp. B. R. MCBATH assumes responsibility as engineer in charge of the centrifugal engineering division, succeeding Mr. Sizer.

♦

U. A. WHITAKER, research director of American Machine & Foundry Co., Brooklyn, N. Y., has been elected a member of the Industrial Research institute, an affiliate of the National Research council.

♦

PAUL S. MENOUGH has been named chief engineer by the Standard Alloy Co., Cleveland. He was formerly connected with Duraloy Co., Michigan Steel Casting Co. and Michiana Products Co.

♦

JED S. FOSTER, vice president and chief engineer of Lidgerwood Mfg. Co., Elizabeth, N. J., was recently honored at a testimonial dinner in recognition of his fiftieth anniversary of active service with the company. Mr. Foster during recent years has designed machinery that has been an important factor in development of water power and irrigation systems throughout the United States and abroad.

♦

JOHN E. SNOWBERGER who has been connected with Willys-Overland Motors Inc., for the past 19 years, recently serving in the engineering and research departments of the company, has been appointed works manager of the company's factory in Toledo, O.

♦

VLADIMIR KARAPETOFF, a faculty member of the college of engineering, Cornell university, retired recently as professor of electrical engineering, and has been made professor emeritus by the board of trustees.

"40% FASTER-20% EASIER"

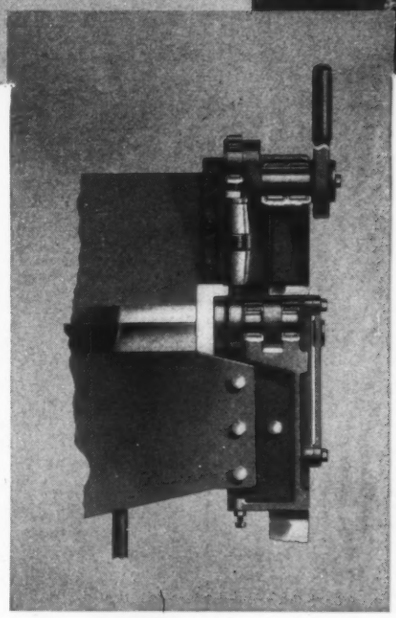
WITH THE TORRINGTON NEEDLE BEARING

The Whitney-Jensen combination bending brake in use. Torrington Needle Bearings have increased the ease and speed of operation.

TORRINGTON Needle Bearings are standard equipment now on all Whitney-Jensen combination bending brakes—because experience has proved that their operation is far faster and easier when Needle Bearings are used.

Whitney Metal Tool Company, manufacturer of the brakes, tested the Needle Bearing in comparison with bushings on apron supports and eccentric shafts. Here's what their engineers report:

"The force necessary to swing the apron when making a bend was decreased by 12 to 14%. The force required to pull down the upper jaw when pressing seams to flatten them out after



View showing the location of the Torrington Needle Bearings on the bending brake. Note the simplicity of housing design.

bending was decreased by 32%, and the force necessary to release the clamping handle from the over-center position was decreased by 90%."

Whitney customers were quick to appreciate the advantages of the Needle Bearing. One customer reports that his production has been doubled by the Needle-Bearing-equipped brakes. Other users of bushing-equipped brakes have had Needle Bearings installed at their own expense—in order to gain these advantages of improved operation." In general," says the Whitney Metal Tool Company, "the Needle Bearing brake is 40% faster than the same brake equipped with plain bearings and is 20% easier on the operator."

Translate these remarkable operating improvements into terms of your own products. Consider that the Needle Bearing gives you anti-friction operation, with high load capacity, in a low-cost, compact unit that is easily installed, and frequently occupies no more space than a plain bushing. Let the Torrington Engineering Department show you how easily your product designs can be adapted to incorporate the advantages of this unusual bearing.

For further information write for Catalog No. 9. For Needle Bearings to be used in heavier service, request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Ind.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings

Branch Offices in all Principal Cities

TORRINGTON
NEEDLE BEARING

Micro-Weave
ALL-AMERICAN
TRACING CLOTH

All specifications that have been set up for Tracing Cloths require necessarily high standards — but Holliston Microweave Tracing Cloth is made to top them — in minute perfection of weave — in transparency—in durability under repeated erasure — in maximum strength with minimum bulk. For fine detail work, exacting draftsmen will approve the high, uniform transparency of this superior cloth.

Microweave Tracing Cloth is an all-American article that challenges the best the world can produce. Every step of its manufacture is controlled by the most modern methods. Try it and you'll say thereafter, "More of the same." A generous working sample on request.

Companion Products: Royal Blue Print Cloth and Photo-Cloth

THE HOLLISTON MILLS, INC.
NORWOOD, MASSACHUSETTS
Boston · New York · Philadelphia · Chicago · St. Louis

Fresh, clean and smooth—packed in a handy "Dispenser Box" with brackets for attaching to wall or desk, if desired.

Scanning the Field

(*Concluded from Page* 36)

operation has no effect upon the properties of this material. Automobile type lamps are used instead of flashlight bulbs. The latter have relatively short life whereas automobile lamps give long service and are resistant to vibration.

Bearing Utilizes Labyrinth Seals

PROBLEMS involved in providing adequate seals for ball bearing mountings have long been familiar to designers. Not only must the lubricant be kept in and foreign particles kept out but the design also should permit accessibility and not involve intricate or costly parts. A new seal design known as "Mechani-Seal" has been developed by the Fafnir Bearing Co. employing labyrinth seals which are integral with the bearings as illustrated in *Fig.* 3. This seal is highly efficient and suitable for severe applications within the speed range of the bearing.

Two steel plate shields, widely separated to form a trap, serve as the innermost members, both attached

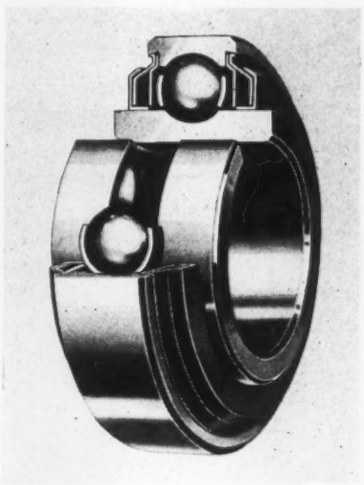
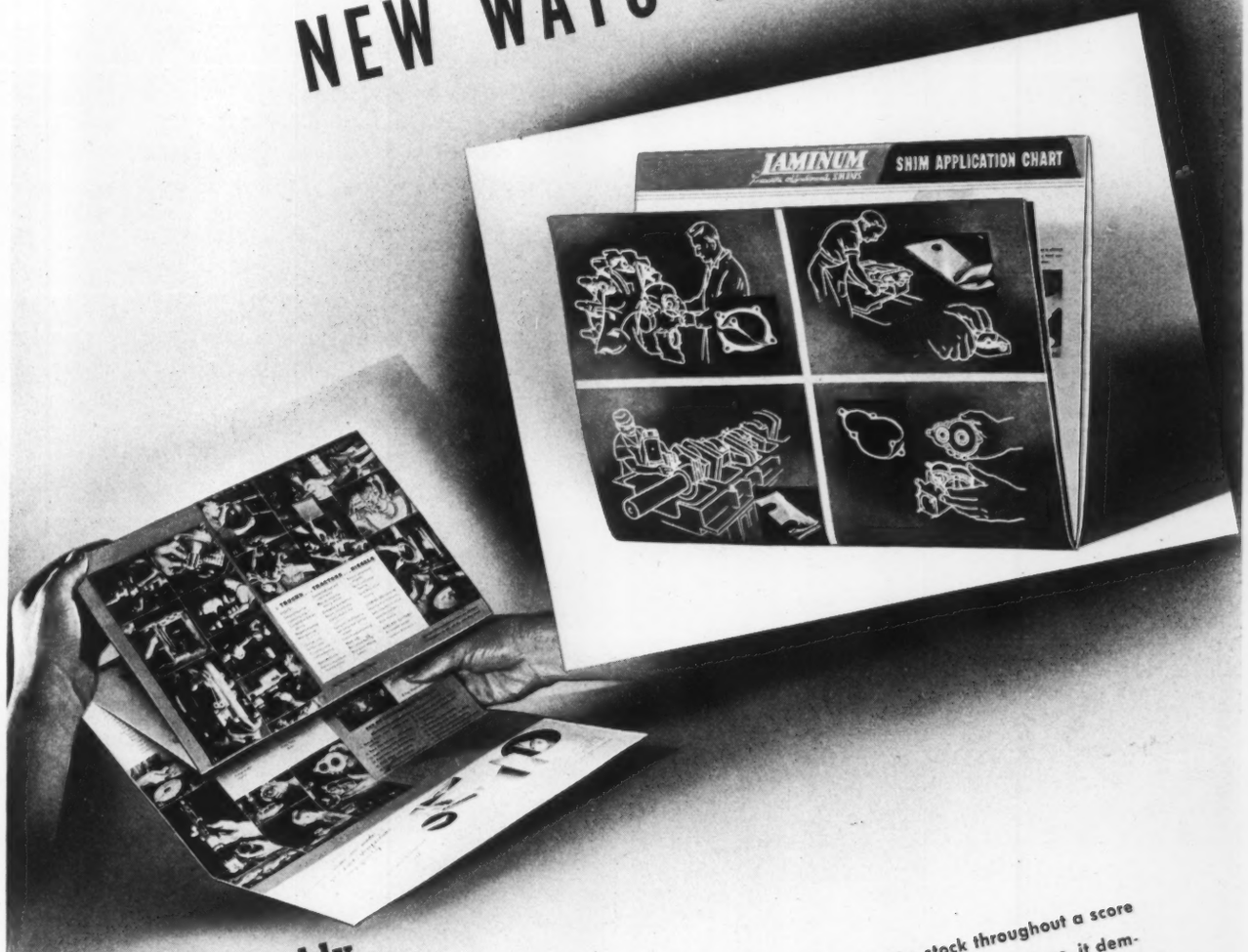


Fig. 3 — Cutaway bearing with seal arrangement consisting of steel plates on bearing rings

to the outer bearing ring. Another steel plate, pressed on the bearing inner ring, acts as a slinger when this inner ring is rotating. Definite though extremely close clearances exist between the individual members so that there is no additional bearing friction. Tests in dust chambers have shown that no foreign particles entered the bearing proper at speeds ranging from 300 to 2000 revolutions per minute and at an estimated equivalent of thousands of hours in normal service.

Even in extremely severe operating conditions it is not required to use supplementary sealing devices. Bearings are designed with single or double seals and shield combinations.

USE IT *to find* NEW WAYS TO SAVE . . .



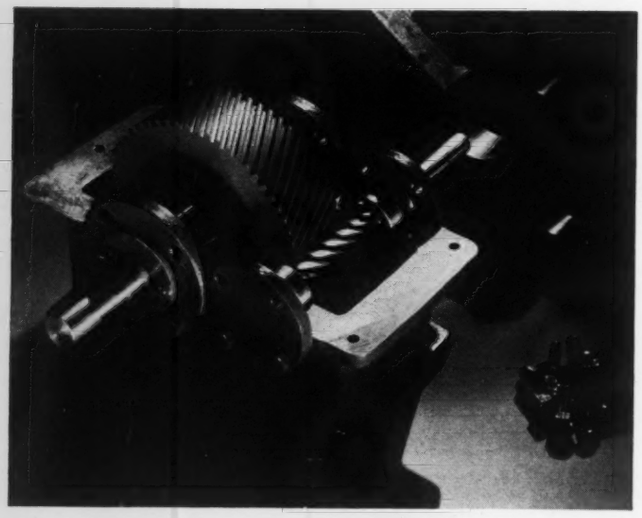
In factory assembly and service adjustments

● This new chart classifies approved uses of LAMINUM shims and shim stock throughout a score of industries . . . from aviation to diesels. With nearly fifty photographs of applications, it demonstrates the latest methods in factory assembly and service adjustments. The chart will show you what savings and precision are now made possible by LAMINUM . . . the "solid" brass shim that simply P-E-E-L-s for accurate adjustment—right at the job. Your choice of .002 or .003 inch laminations. (A Laminum sample will be mailed you together with the chart.)

LAMINATED SHIM CO., INC., 21-88 44th Avenue, Long Island City, New York, N. Y.
CLEVELAND DALLAS HOUSTON LOS ANGELES MILWAUKEE TULSA

1327

THE SOLID SHIM THAT LAMINUM TRADE MARK *peels* FOR ADJUSTMENT



No. 700 and 800 Helical Gear Type

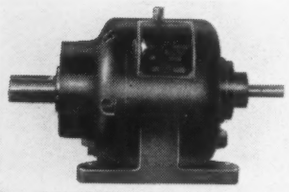
SPEED REDUCERS
FOR EVERY NEED

The country's oldest specialists in speed reducing equipment offer you, in addition to a time-tested and complete line, *over 20 years of experienced engineering service....* at your disposal, without obligation!

It's New!

A NEW SIZE

STREAMLINE DESIGN NO. 7



Differential

WHS
SPEED REDUCER

Typical of constant progress in meeting every speed reducer problem. *Timken Bearings* on high and low speed shafts. Quiet-running; unusually compact; exceptional range. *Get our low prices. Send for catalog.*

WINFIELD H. SMITH, Inc.
A Speed Reducer for Every Application
16 ELTON STREET, SPRINGVILLE, ERIE COUNTY, N. Y.

Combination of Properties Features Malleable

(*Continued from Page* 39)

5. Avoid as much as possible designs which require dry sand cores, because of the danger of ruptures which may occur when the metal contracts over an unyielding core during cooling.

Malleable iron does not lend itself readily to welding because this operation involves heating the metal far above the critical temperature range, the carbon in the nodules going back into solution in the metal. Upon cooling, all of the fusion zone and most of the gradation zone of the weld becomes hard and brittle and for this reason welding should be approached with caution. In order to restore the affected metal to a malleable condition it is necessary to reheat the welded casting to just under the critical temperature range for a few hours. Welding in any case should be carried out under very closely controlled conditions.

Malleable iron parts may be successfully brazed provided care is taken to avoid heating the casting above about 700 degrees Cent. (1292 degrees Fahr.).

Not a great deal of comparative data have been published concerning the relative corrosion resistance of malleable iron, but it is generally considered to be excellent and the equivalent of wrought and cast iron in this respect.

Metallic coatings are frequently applied to malleable iron castings for protection against corrosion or to make their appearance harmonize with other parts. Zinc applied by the hot dip galvanizing process and cadmium plate, applied by the electroplating process, are most frequently used. The former usually is the more effective in preventing corrosion partly because of the much heavier coating ordinarily obtained.

Galvanizing May Reduce Ductility

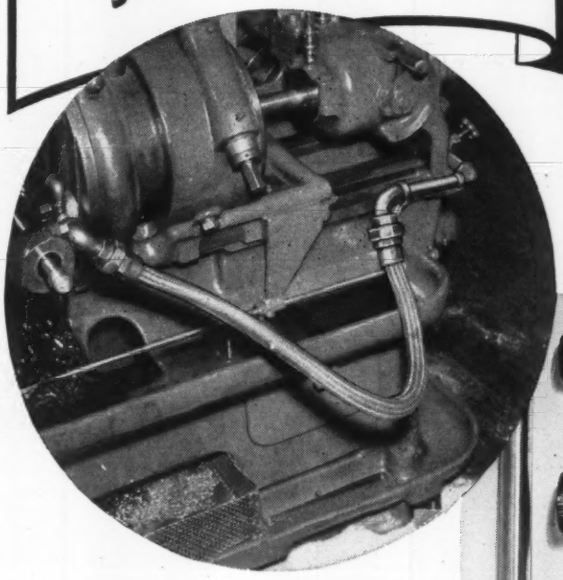
Reduction in ductility of the metal may result from galvanizing or by simply heating to the galvanizing temperature (about 460 degrees Cent., 842 degrees Fahr.) causing the metal to break, giving an intergranular fracture. This embrittlement can be prevented by proper treatment. One method, found by Marshall at the National Bureau of Standards (the process is controlled by patents), consists of heating the annealed casting before galvanizing to about 1200 degrees Fahr. and quenching.

To prove that hot-dip galvanizing has not caused embrittlement of malleable after castings are given proper preventive treatment, an impact test on wedges is sometimes made by foundries. A typical galvanized wedge is 6 inches long, 1 inch wide, and tapers from 1/16-inch thick at the tip to ½-inch at the base. In the test, the thin end of the wedge is bent over slightly with a hand hammer and the specimen is

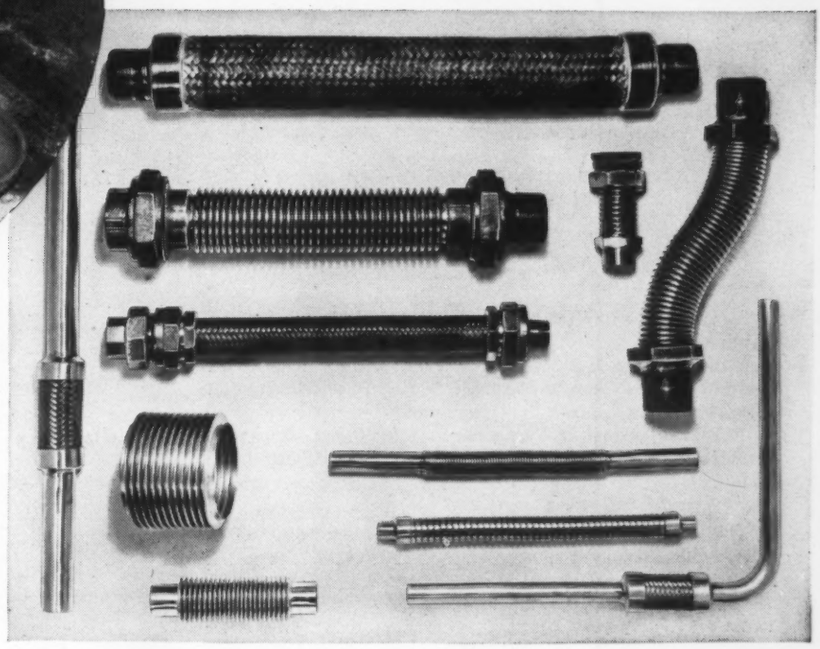
The toughest Tubing you can specify...

American Seamless Flexible Metal Tubing

The ideal method of conveying steam, oil, air, liquids and gases to moving mechanisms



ABOVE— *American Seamless Flexible Bronze Tubing with soldered on couplings for conveying coolant oil on a modern machine tool.*



RIGHT— *Just a few of the many thousands of special assemblies that we have designed for specific application in modern machine design. Let our engineers submit their suggestions for solving your problem.*

MODERN DESIGN ENGINEERS are agreed that the one best method of heating, cooling or lubricating moving parts on machinery involves the use of *all metal* flexible hose and tubing. Because in metal they can be certain of obtaining dependable connectors with the strength and ruggedness of the machine itself. No wonder then that American *Seamless* enjoys such widespread popularity with leading machinery designers.

American *Seamless* is actually made of seamless tubes —corrugated to assure extreme flexibility and jacketed with wire braiding to impart maximum strength. It's the ideal flexible connector for misaligned or moving parts . . . for absorbing vibration . . . for the dependable conveyance under pressure of air, steam, oil, water, and gases. American *Seamless* is *all metal*—with no joints, welds, laps, seams, or packing of any kind. It's the toughest tubing you can buy.

Write us about your connector problems. Our engineering department has complete information on the use of American *Seamless* on all types of equipment. When writing ask for our free reference handbook, Bulletin SS-25. 39241

American Metal Hose

ANACONDA from mine to consumer

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Got a Problem **FOR YOU JIM!**

• The name "Lewellen" comes quickly to mind when mention is made of variable speed control. *Here's why:* Lewellen's record book contains the solution to thousands of speed control problems. A new chapter is added to this book each year. It contains 42, now.

Why not be certain that you are getting top efficiency from your production machines? With the application of Lewellen Variable Speed Control unit costs are reduced —PROFITS INCREASED.

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Lewellen knows speed control

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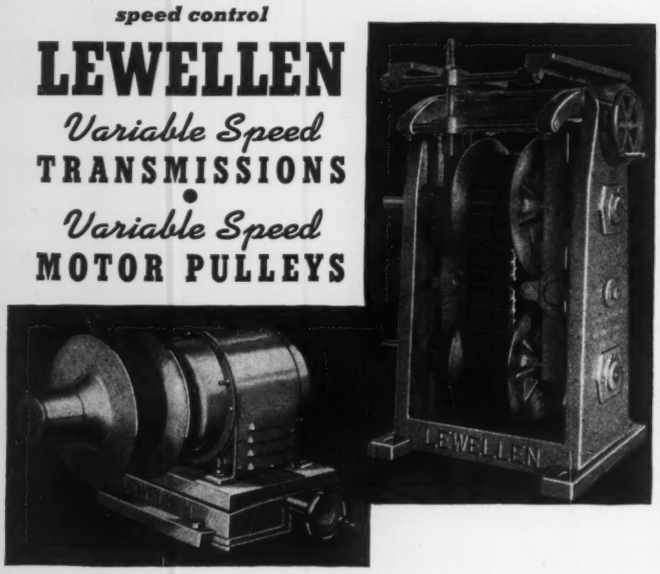


placed, thick end down, in an upright position on the anvil of the testing machine. A 21-pound tup is then dropped 3 feet 4 inches, striking the thin end a blow of 70 foot-pounds. The number of blows the wedge sustained before failure or fracture, is taken as an indication of the impact resistance of the metal. Twenty blows are taken as the number that should be endured before fracture of good malleable iron. Usually, however, the wedges receive 30 blows with no sign of fracture.

The necessity for correlating design with practical foundry problems cannot be overemphasized. A design must be so adapted that it is physically possible, with proper foundry skill and technique, to produce the casting free from defects. It is not reasonable to expect the designer to be an expert foundryman, nor the foundryman an expert designer. Before completion of important casting design, the practical foundryman should be called in to examine it from the standpoint of foundry practicability. Often he will be able to suggest some slight changes which will not only insure sound castings and the avoidance of field trouble but will reduce the cost of the casting as well.

Where Streamlining Counts!

STREAMLINING and its definitions have been the subject of prolonged controversy. It is certain, however, that John R. Cobb, the British fur broker who recently set a land speed record of 368 miles per hour, knows the principles and has applied them in his automobile. Tear-drop construction is so marked that the car's front tread is seven feet while the rear wheels are only two feet six inches apart. Metal at the front is so light it can be dented with a finger; the rear end is so strongly built in comparison that a 200-pound man can jump on it. Yet after the run the relatively fragile front showed no change in structure, while the rear end quite evidently had been pinched in by the tremendous wind pressure. The need for good design in other respects is amply indicated by the fact the car uses virtually a gallon of gasoline per mile; at full speed the tires are one inch larger in diameter than at rest; there are 30,000 explosions per minute in the 24 cylinders, wheels go around 46 times a second; in a minute a tire's temperature goes up to the boiling point of water and the tire tends to fly apart with a force of about 12 tons.

Equally significant in the automotive field is the announcement by Nash of plans for equipping its cars abroad with diesel engines which match gasoline engines in weight per horsepower. The familiar advantages of diesels are claimed, including use of nonvolatile fuel, more consumption and less waste of heat energy, harmless exhaust gas.

HYATTS ARE *Right* IN THE CENTER OF ACTION

ACTION *CENTERS* AT THE BEARING POINTS, where power meets load—where you must guard against friction, waste, wear, maintenance, replacements, shut-downs. And here, where the battle for efficiency is fought, Hyatt Roller Bearings are used with the utmost of confidence.

Confidence enriched by years of successful experience with these better bearings...confidence in correct bearing design, precision manufacture, sturdy construction, and sound application...confidence that in the centers of action Hyatts will always serve well and long. Hyatt Bearings Division, General Motors Sales Corporation, Harrison, N. J., Chicago, Pittsburgh, Detroit and San Francisco.

HYATT ROLLER BEARINGS

NEAT

One reason so many designers are insisting upon the use of

Fig. 1434
Pat's. Pend'g.

KNURLED

UNBRAKO

SOCKET HEAD CAP SCREWS

is the fact they actually dress up the completed product on which they're used. It's the distinctive knurling on the heads that makes "Unbrako" Screws have that really finished appearance. Get a sample and see for yourself.

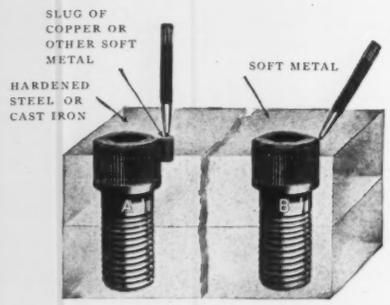
—and another exclusive

UNBRAKO

feature

They're easily locked after countersinking

There are two simple but effective methods whereby the Knurled "Unbrako" can be locked after countersinking, one of which is shown here.



No other socket head cap screw gives you all the advantages found in "Unbrako". Get our catalog that explains them in detail . . . and don't forget to ask for samples.

STANDARD PRESSED STEEL CO.

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JENKINTOWN, PENNA.

BOX 102

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

Color Helps Sales!

(*Continued from Page 42*)

Any color that contains red or yellow is a warm color. Any color that contains blue is considered cold. There are warm yellow-greens and cool blue-greens.

4. A color combined with its complementary color can provide the greatest contrast that it is possible to achieve. Examples of perfect complementary color groupings include: Red and blue-green; yellow and purple-blue; yellow-red and blue; purple and yellow-green. When the colors employed in this type of relationship are at maximum intensity of purity or chroma, the greatest possible color contrast is achieved since a complement imports added vigor to the other when juxtaposed.

5. A small area of a machine finished in one color and the major area of the machine finished in another color affords the only other method for securing contrast.

Any color treatment that commands unusual attention and excites general admiration will be found to be in accord with the few laws which regulate the distribution of color in nature. It will excel to the degree that it possesses fitness, proportion, harmony and the repose that the ultimate results produces in the eyes of observers.

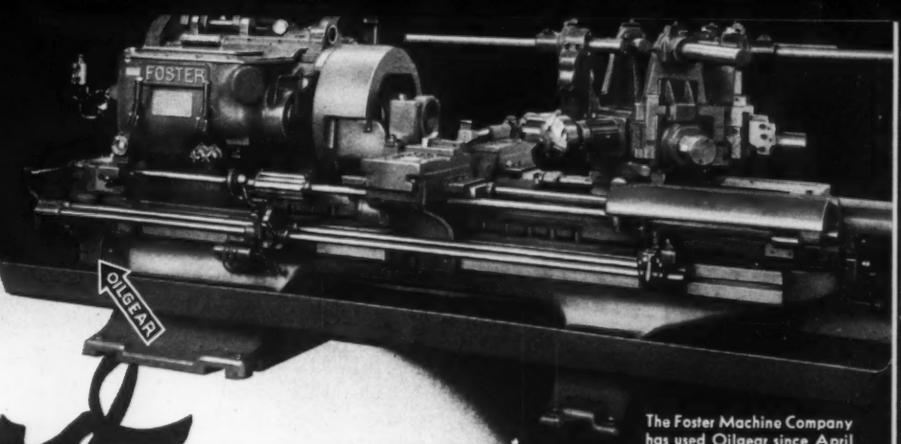
There are many varieties of each hue. The color of an orange skin is not the sole representation of the yellow-red (orange) color family. One basic color chart recognizes three yellows, two oranges and four reds as having exceptionally fine identity and visibility ratings when viewed at a distance. These colors are: Light yellow, lemon yellow and medium chrome yellow; medium orange and orange; light red, bright red, maroon red and tuscan red. Similarly, their versions of light blue, light green, cream and light gray are effective because of their splendid color quality and high visibility ratings.

Making Lettering Legible

Color helps to develop legibility of lettering and when properly employed, enables the eye to distinguish letters or words readily. In machine design such treatment insures adequate readability for trademark designations, notices and operating directions. When lettering in one color is applied to a machine finished in a contrasting hue, the lettering will be more legible if it is separated from the ground color by an edging of lighter color. Let us assume that a red letter is to be put on a grass green machine. The lettering will be more easily read if it is outlined in lighter green.

Lettering on a gold background should be separated from the ground by an edging of darker color. Gold lettering on any colored ground will be more

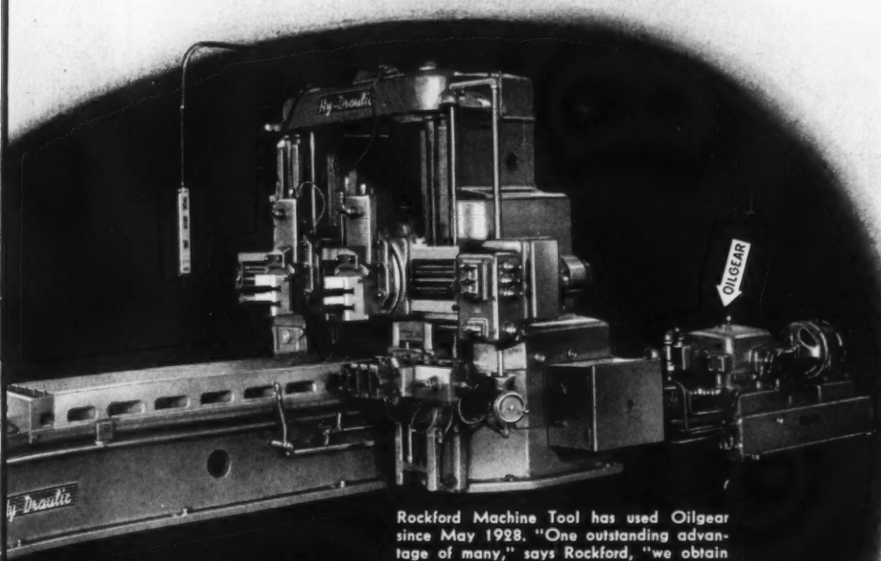
Thompson-Gibbs have used Oilgear extensively on their welders since 1923, to provide greater convenience, more accurate control and other advantages.



The Foster Machine Company has used Oilgear since April 1923. L. D. Tyson, chief engineer, says: "Oilgear reduces cost and presents increased production. It removes limitations, provides compactness and other advantages."

"USED AS *Standard* EQUIPMENT FOR 14 YEARS"

A TIP TO MANUFACTURERS OF MACHINES AND MACHINE TOOLS



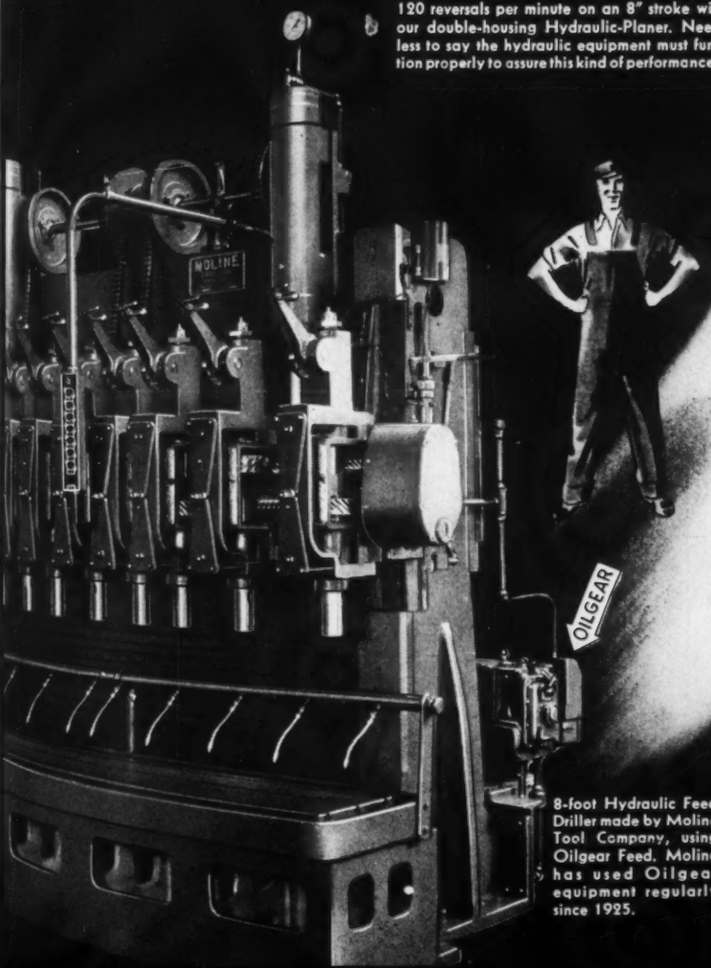
Rockford Machine Tool has used Oilgear since May 1928. "One outstanding advantage of many," says Rockford, "we obtain 120 reversals per minute on an 8" stroke with our double-housing Hydraulic-Planer. Needless to say the hydraulic equipment must function properly to assure this kind of performance."

"The fact that since 1925 we ha
Oilgear equipment for feed on d
boring and special milling mac
and for the reciprocating action o
tiple spindle honing machines, sl
be ample evidence of our satisfa
with the equipment and service
nished by Oilgear. At no time in the
14 years have we had any compl
from our customers in regard to Oilg
equipment."

So writes the Moline Tool Comp
. . . and in doing so they speak for m
other leading manufacturers who h
standardized on Oilgear Fluid Po
Pumps and Motors for periods rang
from 10 to 17 years. One manufactu
has applied Oilgear Power to 1700 un

Oilgear units give trouble-free servi
but in addition they permit speed
operating control and convenience, fle
ibility of application and many oth
advantages to a degree unequalle
This is a matter of factual record.

You are invited to send for the 64-p
Handbook on Oilgear Pumps and Mot
Use the handy coupon TODAY.
OILGEAR COMPANY, 1310 W. B
Street, Milwaukee, Wisconsin.



8-foot Hydraulic Feed Driller made by Moline Tool Company, using Oilgear Feed. Moline has used Oilgear equipment regularly since 1925.

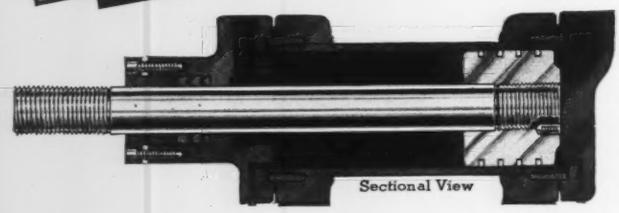
OILGEAR
Trademark
Reg. U. S. Pat. Off.

OILG

THE MOST EFFECTIVE APPLICATION OF *fluid power*

Co

BETTER hydraulic power for modern machine tools . . .



Sectional View

Hannifin patented high pressure hydraulic cylinders have stronger, simpler construction, and are easier to apply. All the advantages of high efficiency hydraulic power for many different machine tool purposes are easily obtained, with an economical installation.

Note these features: *No tie rods.* End caps may be removed without collapse of other parts. *Universal caps.* Positioned independently with inlet port at top, bottom, or either side. Caps may be moved without disturbing mounting. *Air vent plugs.* Each cap has air vents on three sides. *Leakproof.* Special mirror finish honing produces a straight, round, perfectly smooth cylinder bore. Perfect piston seal with minimum fluid slip is assured.

Hannifin high efficiency hydraulic cylinders are available in six standard mountings, with small diameter piston rod, 2 to 1 differential piston rod, or double end piston rod, in all sizes, for working pressures up to 1000 and 1500 lbs./sq. in. Furnished with or without cushion. Other types built to order, any size, for any pressure. Write for new Bulletin 35-MD with complete specifications.

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621-631 South Kolmar Avenue, Chicago, Illinois
Engineers • Designers • Manufacturers
Pneumatic and Hydraulic Production Tool Equipment

HANNIFIN
HYDRAULIC CYLINDERS

easily read if it is outlined in black. Lettering of most other colors should be separated from backgrounds by the use of white or gold outlines. Against a white or black machine any colored lettering, even gold, will be sufficiently legible without an outline or edging providing the value of the lettering color employed is not so close to black or white as to lose contrast.

Printing reproduced in a high value color such as light red will contrast properly against a machine colored maroon, without an outline. In general, this holds true for every use of two values of the same hue. It is not always practical to mix hues. For example, a high value of red would not prove very legible against a dark green background. Dark colored letters displayed against a light colored machine require an outline in a still darker value. A red letter on a pink background will be more legible if it is outlined in maroon. Equal emphasis in distinction, naturalness and readability can be achieved advantageously in no other way in the color-lettering of machinery.

The day of battleship gray as an overall color is doomed. Forms and functions of all parts of a machine must be related to assure proper unity. While it is true that color harmony can be imparted by appropriate grouping of colors such as variations of a single hue; light, medium and dark yellow; yellow-red with brown, or light green with dark blue, etc., or the use of neighboring hues such as red and purple-blue among others, pleasing hue and harmonious color do not necessarily assure popular acceptance of a machine.

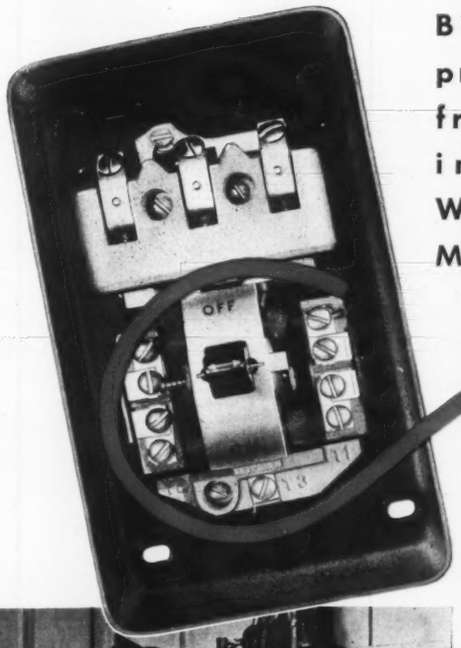
It is not price alone that sells in today's marts. Too many producers are equal in quality and cost. The deciding factor in many successful machine designs today may well be pre-tested color and styling appeal.

X-Ray Finds Depth of Flaws

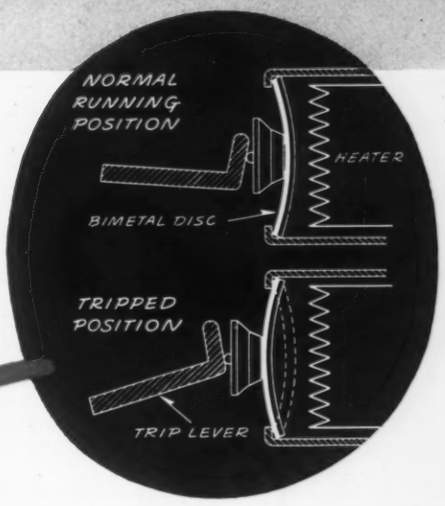
TWO X-ray photographs taken at an angle of about 5 degrees apart make possible the studying of flaws in materials and locating them readily within an accuracy of 1/16 inch in a method developed in the laboratories of General Electric Co. The two views are placed in a stereoscope which merges them into a single picture for the eye. To convert the apparent depth into terms of actual measurement, it is necessary to project an imaginary ruler into the solid.

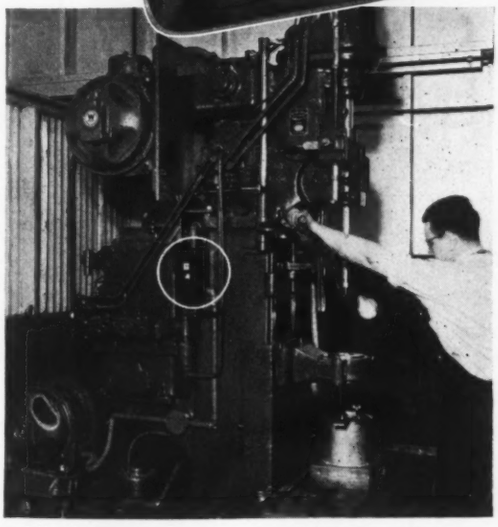
Two wires in stereometer form the ruler. As they are moved to one side or the other they appear to approach or recede. When they correspond with the position of a flaw, the actual depth is read from a scale without computation. This method permits study of dimensional relations of one flaw to another and determination of the amount of dip or rise in extended flaws known as "pipes."

lifetime calibration



Bi-metal disc protects motor from overload in this new Westinghouse MOTOR STARTER





Nothing to renew or replace

In this new manually operated motor starter, a snap action bi-metal disc protects the motor from overload. When heated by an overload current, it automatically disconnects the motor from the line before heat can damage windings. The bi-metal disc simply snaps back to normal running position — there is nothing to renew, adjust, or replace. The calibration of the bi-metal does not vary even after repeated operation.

Specify the starter with these moneysaving features

- "De-ion" Arc Quenchers prevent flashovers — prolong contact life.
- Indicating handle shows clearly whether starter is On, Off or Tripped.
- Safety interlock prevents accidental contact with live parts.

The Westinghouse "De-ion" Motor Watchman is available for motors up to 7½ hp. Your nearest Westinghouse distributor stocks them, or you may get complete data from any Westinghouse office or industrial agent.

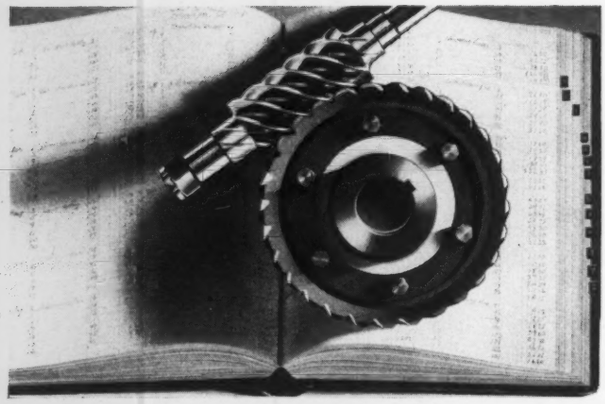
WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa.

J-20850

Westinghouse

"De-ion" Motor Watchman

W
WESTINGHOUSE ELECTRIC



Clevelands Make Machines Pay Back Faster . . . Because

THEY OUTLIVE THE BOOKKEEPER

• Accurately-kept performance records *prove* that Cleveland Worm Gear Speed Reducers make machines pay back faster—by delivering power reliably, regardless of shock load, during every hour that machines operate.

In more than 20 major industries, equipment of many types driven by Cleveland Worm Gear Speed Reducers has continued in full operation through 12, 15 or even more years, with no need for repair or parts replacement on the Drive Units.

Have you a reference copy of the Cleveland Worm Gear Catalog in your files? Elaborate engineering data and clear, interesting illustrations provide valuable help in drawing worm gear drive specifications.

Cleveland District Representatives will gladly call for consultation with your own Engineers relative to the correct applications—whether standard or special—of Cleveland Worm Gear Drives to the machines you build. The Cleveland Worm & Gear Company, 3275 East 80th St., Cleveland, Ohio.

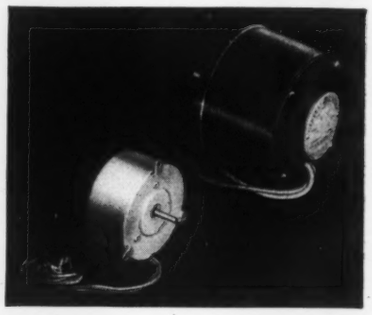
Affiliate: The Farval Corporation, Cleveland, Manufacturers of Centralized Systems of Lubrication

CLEVELAND WORM GEAR Speed Reducers

NEW Materials and Parts

Low-Speed Motors Brought Out

FOR use on indicating and recording instruments, small regulating or control devices, remote control devices and similar applications, a new line of alternating current fractional horsepower motors has been announced by General Electric Co., Schenectady. Designated as synchronous self-starting inductor motors, they are especially applicable within their capacity wherever a long-lived source of low-speed torque or power at constant speed is needed. The motors are built in two frame sizes. In the larger size, two motors are available, one delivering 40 ounce-inches torque at 75 revolutions per minute and the other delivering 75 ounce-inches at the same speed. In the smaller frame size four motors are available, a 100-revolutions per minute motor delivering 2 ounce-inches torque, and three motors with built-in gear reduction. The latter are offered in the following torques and speeds: Forty-eight ounce-inches at 1 revolution per minute; 24 ounce-inches at 2 revolutions per minute; and 12 ounce-inches at 4 revolutions per minute. All of these motors in both frame sizes are of the permanent split-capacitor type with separately mounted capacitors.



Fractional horsepower motors are especially applicable within their capacity when low-speed torque is needed

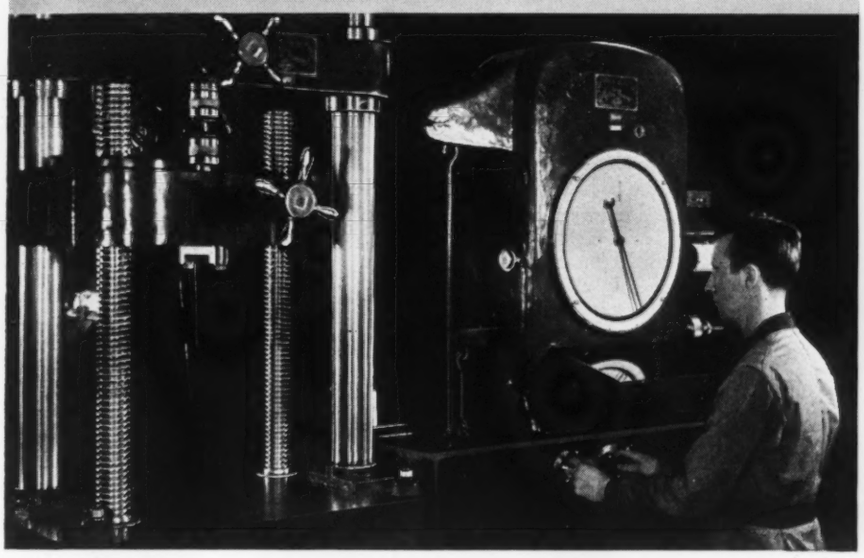
Clutch Needs No Oiling

A NEW automatic centrifugal clutch for all types of industrial power drives is being marketed by Dawes Equipment Inc., Penobscot building, Detroit. Without metal-to-metal wearing surfaces, the clutch requires no lubrication and in tests has shown practically no wear on the friction lining. Two main parts are utilized, the housing drum or driven member and the expansion body or driving member. A steel cover-plate held in position by means of a lock ring seals

A SAFETY FACTOR TO *Resist "Sledge Hammer" Shocks*

—BUILT INTO EVERY PARKER-KALON COLD-FORGED SOCKET SCREW

PRECISE CONTROL OF DUCTILITY—To protect you against failure of socket screws under heavy shock loads, Parker-Kalon controls the vital element of ductility to a "hair's breadth". On this modern Olsen Machine in Parker-Kalon's Laboratory, socket screws are literally *pulled* to pieces, then checked for elongation. You'll never see a brittle Parker-Kalon Cold-forged Socket Screw!

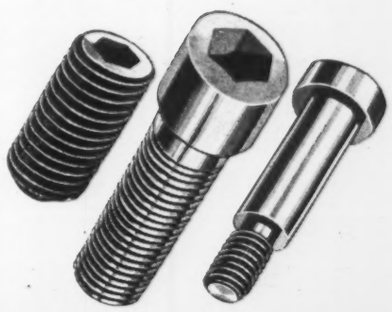


"16 POINT QUALITY-CONTROL" Leads Critical Buyers to Demand PARKER-KALON

A Ductility Test is only one of 16 check-ups on important characteristics of Parker-Kalon Cold-forged Socket Screws. In a laboratory without counterpart in the industry, quality is guarded by thorough tests and inspections covering:

1—Chemical Analysis. 2—Tensile Strength. 3—Ductility. 4—Torsional Strength. 5—Ability to take Shock Loads under Tension. 6—Resistance to Shock Loads under Shear. 7—Hardness. In addition, there is a rigid inspection of these essentials: 8—Head Diameter. 9—Head Height. 10—Concentricity of Head to Body. 11—Socket Shape. 12—Socket Size. 13—Socket Depth. 14—Centricality of Socket. 15—Class 3 Fit Threads. 16—Clean Starting Threads.

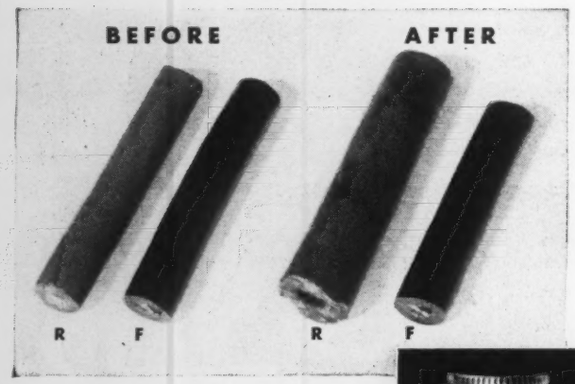
In this way Parker-Kalon maintains a new higher standard of quality in Socket Screws . . . a standard that satisfies critical buyers. Send for free samples . . . see for yourself.



PARKER-KALON CORPORATION, 212 Varick Street, New York, N. Y.

PARKER-KALON *Cold-Forged* **SOCKET SCREWS**

FLAMENOL
REG. U.S. PAT. OFF
WIRE
Resists OIL



Oil causes rubber to swell, does not affect Flamenol

NOTE the size of the two samples of wire at the left—R, rubber; F, Flamenol.

The two samples at the right were also of the same size before being submerged in oil for six months. Note how rubber has swelled. Flamenol has not changed.

At the right, the samples are shown in oil. You can make this test yourself. Send for samples of Flamenol wire.

Wins Customer Acceptance As Wiring on High-quality Equipment

Oil resistance is but one property that has won for Flamenol wide acceptance. Others are: flame resistance, acid resistance, 12 bright colors, small diameter, and long life. Flamenol thus adds a sales feature to any high-grade equipment, such as printing presses, panels, and machine tools.

The more than 5,000,000 feet now in service are solving difficult wiring problems. Perhaps Flamenol can do the same for your product; a G-E cable specialist will gladly help you to determine. Address the nearest G-E sales office, or General Electric, Department 6—201, Schenectady, N.Y.

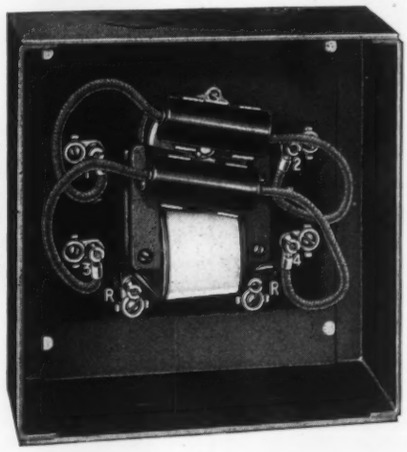
Approved by Underwriters' Laboratories, Inc., for use in oily locations. Bulletin GEA-2733C, dated April, 1939, gives latest details.

GENERAL ELECTRIC

the mechanism. The expansion body consists of six metal segments interconnected by tension springs and operating on individual posts extending radially from the driving hub. Functioning both as a clutch and flexible coupling on direct drives, the clutch can be built to engage smoothly at any desired speed and for any horsepower.

Rotating Relay Made for High Speed

THE M-39 relay announced by The Autocall Co., 32 Mack avenue, Shelby, O., is a new rotating type of relay, employing a tilting mercury switch, designed for high speed operation. Movement of the switch is dampened by the unique magnetic brake. Consisting of an iron tube, insulated cap and refractory breaker, the mercury switch is attached to a rotating disk on the armature shaft of the magnetic element and is unbreakable, eliminating the annoyance



Employing a tilting mercury switch, rotating type of relay is said to be the only such unit designed for high speed operation

of broken "tubes." This breaker shields the metal parts from the arc and retains a pool of mercury in the cap end of the switch so there is always positive mercury-to-mercury contact. The M-39 relay is furnished in two styles, one with a single mercury switch and the other with two switches. At 115 volts alternating current each switch has a breaking capacity of 15 amperes, making it suitable for most signaling problems, industrial applications, etc.

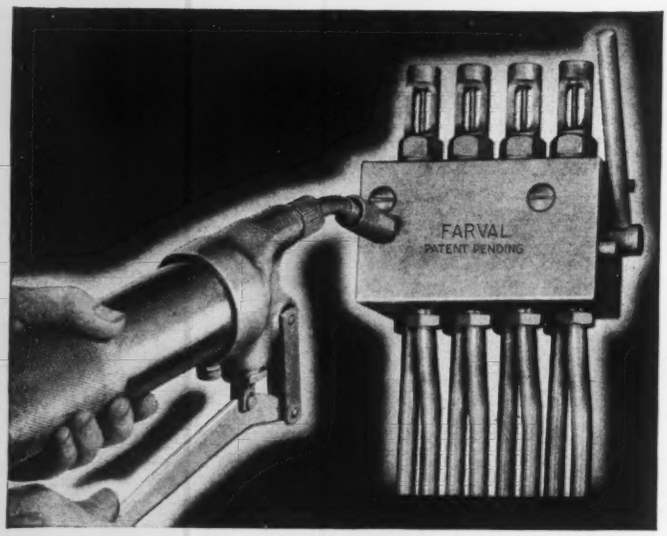
Filter Uses Bypass Principle

WM. W. NUGENT & CO. INC., 410 North Hermitage avenue, Chicago, has added to its original filter more filtering surface and a bypass relief valve in the same container or shell. Degree of filtration in the new 1280A unit, allows satisfactory operation on the bypass partial filtering principle. For instance, in a pressure lubricating system all the oil in circulation may be piped to and from the filter. About one-sixth to one-fourth of the circulated oil passes through the filtering material and the balance is shunted through the bypass relief valve in the filter. A fixed spring in the cover holds the cartridge tightly on the outlet

Progress!

Every month sees **MACHINE DESIGN** more firmly established. Here's the record of advertising pages for the past four months of this year—and the same period of last:

	1939	1938
July	50	31
August	58	40
September	69	45
October	83	75



put **Positive Control**

Between Pressure Gun and Bearings on the Machines You Build! . . . .

Install Farval DX Lubricating Blocks (Multiple Measuring Valves) on the machines you build, and your customers will never need guess how much lubricant—if any!—is delivered to the bearings.

Because—with the Farval DX Block, they can grease *several* bearings from one connection, giving every bearing an exact, measured amount, and have a tell-tale indicator to show the job is done. The amount delivered to each bearing is adjustable and—*not a bearing is missed.*

You can assure this positive control on your machines with the new Farval Multiple Measuring Valves. They are extremely simple in design; can be readily installed at nominal cost; and will last as long as the equipment you build.

Add to the value of your machines. Make them more salable.

Write for bulletin describing the new Farval DX Multiple Measuring Valve. The Farval Corporation, 3265 East 80th Street, Cleveland, Ohio.

Affiliate of The Cleveland Worm & Gear Company, Manufacturers of Automotive and Industrial Worm Gearing

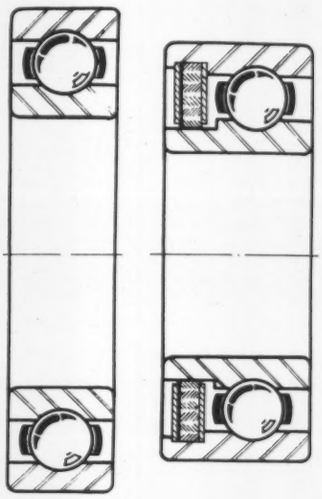
FARVAL

MULTIPLE MEASURING VALVE

seat at the bottom of the shell so that the filter may be installed horizontally or on an angle. Fourten sizes are available, ranging from 5-inch outside diameter by 11¼ inches high to 21-inch outside diameter by 43 inches high.

Light Ball Bearings Save Space

TWO new series of extra light ball bearings designated 6000 and 6100 are announced by Norma-Hoffmann Bearings Corp., Stamford, Conn. These bearings are designed for applications in which minimum weight is sought, center distances are restricted and space is limited. For a housing of given diameter the two series permit use of a larger diameter shaft, and for a shaft of given diameter, use of a housing



When minimum weight is sought and space is restricted, extra light bearings permit large shaft or smaller housing

of smaller diameter. In the 6000 felt-sealed series the sealing devices are wholly within the confines of the bearing and are not exposed to injury. The felt seals are firmly held in the grooves of the outer ring but are removable to permit examination, cleaning or relubrication. The wide, solid inner and outer rings make housing inserts unnecessary. Series 6100 is supplied with one, two or no side plates or shields.

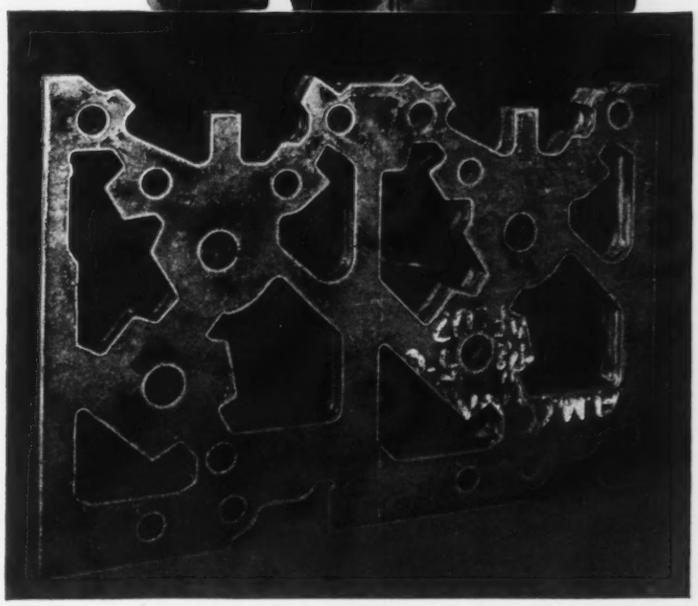
Motors Protected Against Burnout

PROVIDING positive protection against burnout from any source whatever, new Thermoguard motors are announced by Westinghouse Electric & Mfg. Co., East Pittsburgh. The Thermoguard feature gives protection against burnout caused by continuous or frequently repeated overloads, high ambient temperature, high motor current caused by locked shaft or low voltage, or other conditions creating a dangerous temperature. Two types of protection, time-delay and manual-reset, are made, the time-delay type being especially designed for burners with intermittent ignition systems. The manual-reset type Thermoguard is built so that its reclosing temperature is below any ambient temperature. A pushbutton is used for

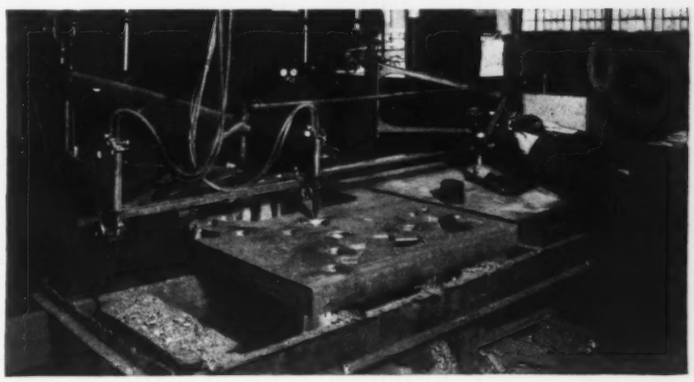
RESULTS WERE LIKE *fingerprints* IN THIS CASE!

The finished cuts on this difficult job were extremely clean and accurate — a typical Airco machine gas cutting job. Specifications were rigid and demanded that the inside cuts in this 4½-inch thick steel printing press frame be to close tolerances. The big difficulty was in piercing the starting holes while still maintaining the required accuracy. The A. M. Castle Company of Chicago was able to maintain the specified tolerances with an Airco Oxygraph Cutting Machine.

Cutting to close tolerances, multiple cutting, flame-hardening or flame-cleaning can be done quickly and economically with Airco High-Purity Oxygen, Airco Acetylene, apparatus and engineering assistance. A new bulletin illustrating some of the many designs which are being successfully flame cut with Airco machines is on the press. Advance copies will be ready for distribution soon. Write for your copy now.



Printing Press Side Frame Having 26 "Inside Cuts."



Oxygraph Cutting Printing Press Frame from 4½-inch steel slab.

AIR REDUCTION

SALES COMPANY

General Offices: 60 EAST 42nd ST., NEW YORK, N. Y.

DISTRICT OFFICES IN PRINCIPAL CITIES

AIRCO *Anything and Everything for* GAS WELDING or CUTTING and ARC WELDING WILSON

WHETHER your "specs" call for a single spur or sprocket (readily available from Ohio's big stocks) or an intricate drive, requiring precision engineering, you'll find that Ohio Gears and Reducers fit those specifications in every detail of tooth, pitch, face, bore and material.

You'll find too, as Ohio Gear customers know, that service is prompt and intelligent, that new, or tough transmission problems have a way of getting solved, and that delivery promises are kept.

Get the facts on Ohio Gear for your own requirements in Gears, Speed Reducers and Power Transmission Equipment. Write, wire or phone the nearest representative.

THE OHIO GEAR CO.

1338 E. 179th Street • Cleveland, Ohio

Representatives

*NEW YORK CITY, N. Y. Patron Transmission Co., 154-156 Grand Street.
*LOS ANGELES, CALIF. J. W. Minder Chain & Gear Co., 927 Santa Fe Avenue.
*SAN FRANCISCO, CALIF. Adam-Hill Co., 244-246 Ninth St.
*INDIANAPOLIS, IND. A. R. Young, 518 North Delaware Street.
PITTSBURGH, PA. Industrial Sales & Engineering Co., Box 8606, Wilkinsburgh, Pa.
DETROIT, MICH. George P. Coulter, 332 Curtiss Building.
BUFFALO, N. Y. F. E. Allen, Inc., 2665 Main Street.
*KANSAS CITY, MO. Kansas City Rubber and Belting Co., 712 Delaware St.
GRAND RAPIDS, MICH. W. H. Slaughter, 419 Oakdale St., S. E.
NEW ENGLAND, George G. Pragst, 260 Esten Ave., Pawtucket, R. I.
LOUISVILLE, KY. Alfred Halliday, 330 Starks Building.
SALT LAKE CITY, UTAH. A. O. Gates, 619-629 South Fifth West Street.
ST. LOUIS, MO. St. Louis Tool Co., 2319 N. Ninth St.

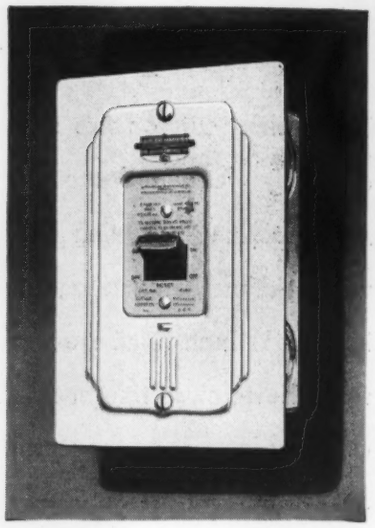
*Stocks carried.

OHIO GEARS

manually resetting. These motors are split-phase general purpose type, in suitable sizes for domestic oil burner application up to 1/3 horsepower.

Multi-Breaker Protects Circuits

FUNCTIONING as a service switch, the type MO multi-breaker announced by Cutler-Hammer Inc., Milwaukee, provides overload and short circuit protection on oil burners, stokers, water heaters, refrig-

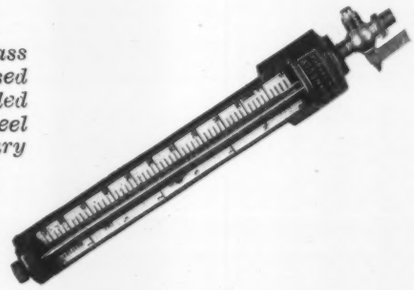


Wherever fused type switches are used, Multi-Breaker provides overload and short circuit protection

erating units, air compressors, etc., wherever fused type switches are used. Service is restored after voltage failure by the resetting of a small, conveniently located switch. Type MO is rated 15-25 amperes.

Mercury Pressure Gage Improved

AN IMPROVED mercury pressure gage has been introduced by Connelly Iron Sponge & Governor Co., 3154 South California avenue, Chicago. Body of the gage is cast semisteel, with an unbreakable glass



Unbreakable glass substitute is used for tube threaded into cast semisteel body of mercury pressure gage

substitute used for the tube, threaded directly into the casting. Wide-angle visibility for reading on the black-etched aluminum scale is provided.

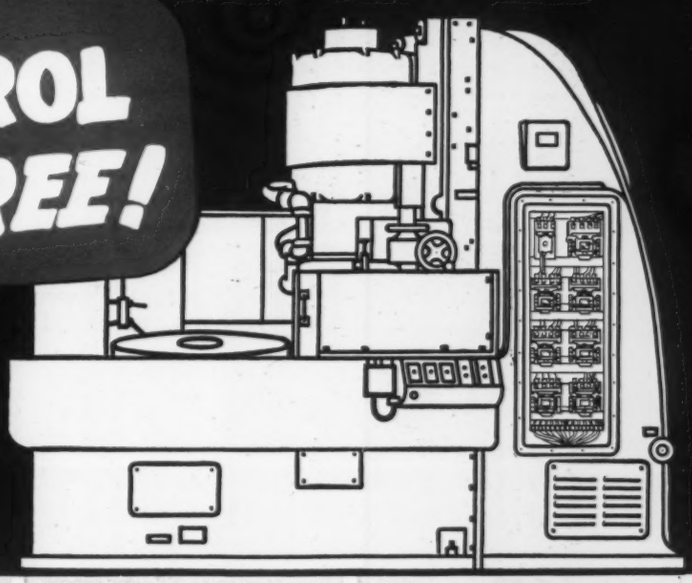
Expand Uses for Wrinkle Finish

DEVELOPMENT of wrinkle finishes for coating flexible materials such as fabrics, paper and leather is announced by New Wrinkle Inc., Dayton, O. After the fabric or paper is coated or sprayed, it

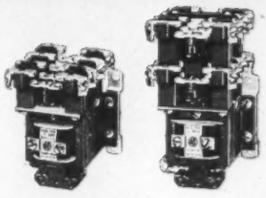
(*Continued on Page* 74)

FOR YOUR MACHINE TOOLS—

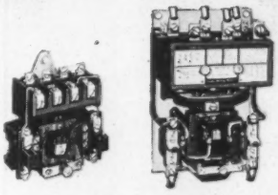
MOTOR CONTROL *that's* TROUBLE-FREE!



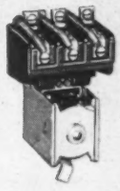
There are fewer moving parts to give trouble in these simple and rugged Allen-Bradley control units. That's why they are preferred by so many machine tool builders. The few standard items listed below are the basic units from which the majority of special Allen-Bradley control panels are built.



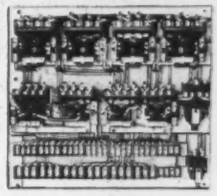
Solenoid Relays
Bulletin 700 — Furnished in over 300 types. One to eight poles. Compact and reliable.



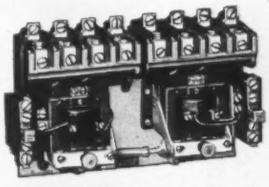
Across-the-Line Starters
Bulletin 709—For across-the-line squirrel-cage motors. Simple, rugged construction.



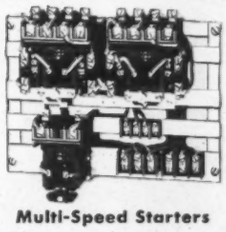
Disconnect Switch Unit
Bulletin 712—Has same interrupting capacity as motor starter—same switch structure.



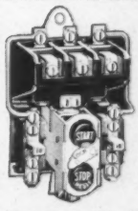
Special Control Panels
Save time and trouble by having Allen-Bradley design and build your control panels.



Reversing Switches
Bulletin 705 — For reversing squirrel-cage motors. Provides solenoid reliability and speed.



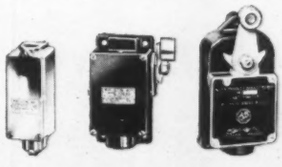
Multi-Speed Starters
Bulletin 715 — For 2, 3, and 4-speed across-the-line motors. Also in the resistance type.



Hand-Operated Switches
Bulletin 609 — A quick action switch. Push-button control and overload protection.

Solenoid Contactors
Bulletin 702—Sturdy construction. Available with 2 to 4 poles—ratings 10 to 100 amp.

Push-Button Stations
Bulletin 800—Designed especially for machine tools.



Limit Switches
Bulletin 801 — Furnished in 253 different types. Limit switches for any machine tool.

A-C and D-C Solenoids
Bulletin 860—Quiet operation. In 8 sizes and various mountings. Thrusts to 16 lbs.

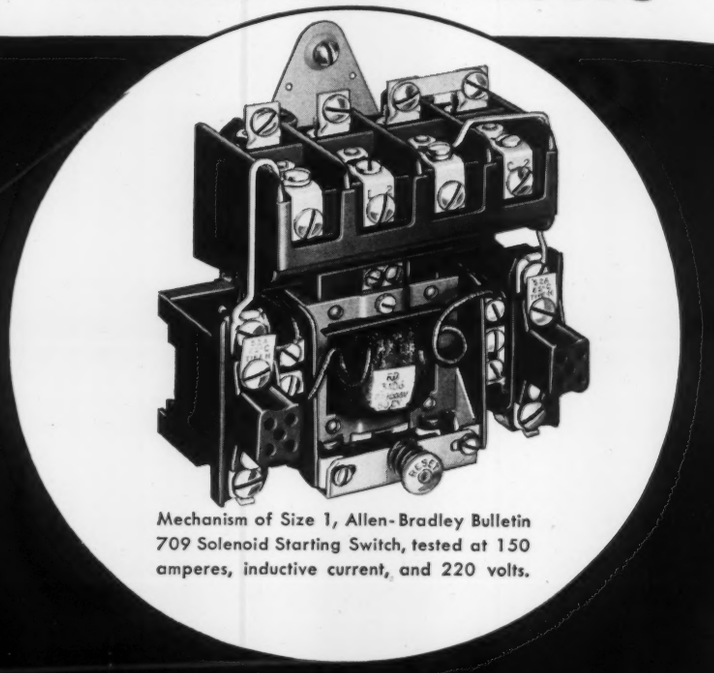
Plugging Switches
Bulletin 802—Used with reversing switches to provide quick stopping of machines.

ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

CONTACT TESTS SHOW 3 MILLION INTERRUPTIONS

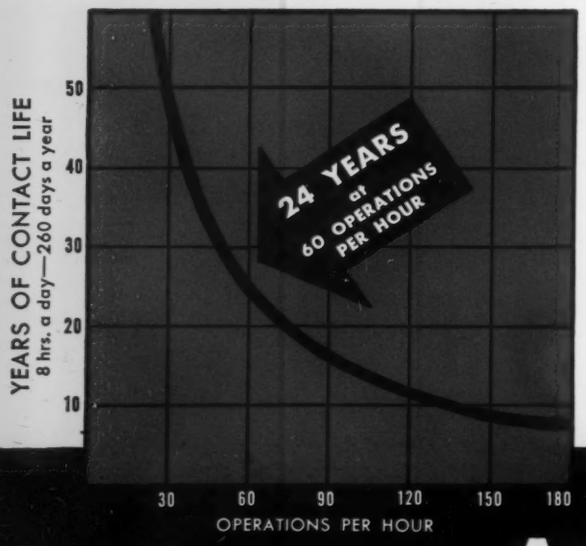


Mechanism of Size 1, Allen-Bradley Bulletin 709 Solenoid Starting Switch, tested at 150 amperes, inductive current, and 220 volts.

Testing an Allen-Bradley Bulletin 709 Solenoid Starting Switch to determine how many times it is capable of interrupting an overload. In this test, which is a particularly severe one, many years of starter life are condensed into a few weeks or months. Thus is starter stamina measured.

—at SIX TIMES RATED CAPACITY!

What this means in Contact Life



Use this chart to determine how long the contacts on a Size 1, Allen-Bradley Solenoid Starter will last on your job with no maintenance or attention whatever.

Imagine, if you can, three million switch interruptions at six times rated load! That's the average life you can expect from the contacts in an Allen-Bradley Size 1 Solenoid Starter, as indicated by actual tests. It's equivalent to one operation a minute continuously, eight hours a day, for 24 years.

The secret of such unequalled performance lies in the contacts themselves and their vertical straight-line motion. These double break contacts, being made of a patented cadmium silver alloy, never need cleaning or filing, as do copper contacts. The cadmium in the contact metal helps to snuff out the arc. Each main contact unit is enclosed in its individual arc chamber, thereby increasing the capacity of the switch, without danger of flashovers. It is no wonder these Allen-Bradley contacts are free from trouble and are good for millions of operations with no maintenance whatever.

Allen-Bradley Company, 1333 S. First Street, Milwaukee, Wis.

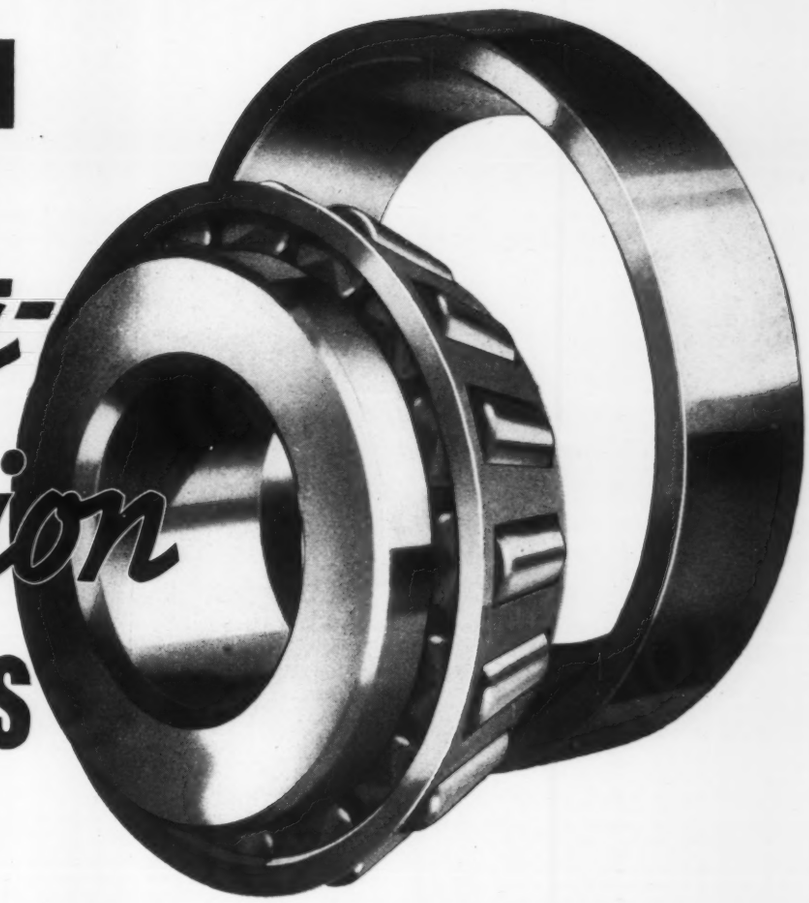
ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

QUALITY

FOR SUPER ACCURATE WORK ON MACHINE TOOL SPINDLES

BANTAM *Ultra-Precision* BEARINGS EXCEL!



BANTAM is building *Ultra-Precision* Bearings for machine tool spindles so accurately that they operate within half of the tolerance usually accepted for super-precision work. The bearing shown is being regularly supplied to one of our customers. The bore is 7″. Their production charts indicate that combined total eccentricity of bearing and spindle is .0002″ maximum. Face runout, .00015″ maximum. Such precision is obtainable on all types of Bantam Bearings —Straight Roller, Tapered Roller, and Ball.

Leading machine tool manufacturers have chosen BANTAMS because of our ability to supply these bearings at reasonable cost. That's possible because of specialized grinding methods which are standard procedure with BANTAM. Our exclusive process grinds both outside and inside diameters at the same setting, insuring uniform wall thickness, and a degree of concentricity and roundness, heretofore unavailable.

If your bearing requirements call for extreme accuracy, it will pay you to write us for complete information.

BANTAM BEARINGS CORPORATION
South Bend, Indiana

Subsidiary of THE TORRINGTON CO. Torrington, Conn.

TAPERED ROLLER—STRAIGHT ROLLER—BALL
BANTAM
BEARINGS

You'll profit by using
ACCURATE
Springs—
Every kind
for every
purpose

WHETHER the springs you use are simple, standard types — or need special engineering—make sure they have the advantage of being Accurate made. A lot of quality and service can be packed into a tiny, hair-like coil. For instance: extra life may be assured by more careful finishing; and perfect uniformity doesn't just happen—it's achieved—by rigid inspection, testing of materials, and control of production methods. When you wisely choose Accurate Springs and find their difference in quality, remember those are some of the "reasons why" they're not just ordinary springs. Into every Accurate product—springs or wire forms—is built the same reliability and guarantee of service. Use them to your advantage . . . it pays to say "Accurate". Ask today for quotations on the springs you need; or if it's something special our engineers will plan with you, gladly.

COMPRESSION SPRINGS
•
EXTENSION SPRINGS
•
TORSION SPRINGS
•
FLAT SPRINGS
•
WIRE FORMS
•
STAMPINGS

CARBON STEEL
•
VANADIUM STEEL
•
STAINLESS STEEL
•
BRONZE
•
BRASS
•
MONEL METAL
•
OTHER ALLOYS

ACCURATE SPRING MANUFACTURING COMPANY
3813 W. Lake Street • Chicago, Illinois

Send for your free copy of our new handbook on springs. It contains formulae and information you will find useful. No obligation.

(*Continued from Page* 70)

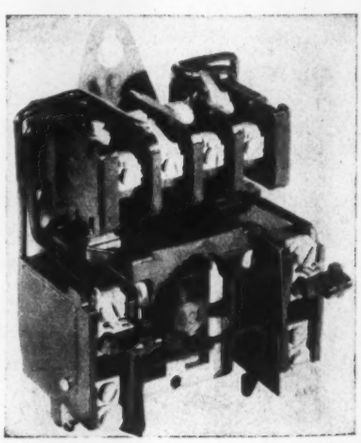
dries into a wrinkle finish of uniform texture, from small to coarse, in much the same manner it finishes metal products, but with a greater degree of flexibility.

Another Motorpump Added to Line

ANOTHER centrifugal motorpump, No. 207, has been added by Brown & Sharpe Mfg. Co., Providence, R. I., to its line of pumps for supplying coolant for machine tools and light machinery where dirt or abrasives may be present in the liquid and where a moderate volume of flow is desired at low head. The pump is similar in general performance to the Nos. 205 and 206, but has a depth of submergence of 12 7/16 inches. At 1725 revolutions per minute these pumps discharge 13¾ gallons of water per minute at a 4-foot head or four gallons of water per minute with a 10-foot head.

Switches for Small Motors Developed

DEVELOPMENT of new size O magnetic switches in a number of popular forms is announced by General Electric Co., Schenectady, for use with single-phase motors up to 1 horsepower, 110 volts, and 1½ horsepower, 220 volts, or polyphase motors up to 1½ horsepower, 110 volts and 2 horsepower, 220 to 600 volts. Made in 2, 3 and 4-pole forms, the switch is available in general purpose, dust-tight and water-tight cases, and may have a pushbutton or selector switch in the cover for local operation. The magnet is the E-type with three sealing surfaces to decrease



Rivet-type, built-in pole shader is used only in small magnetic switches developed in various popular forms

the hammer blow in closing and to increase magnet life. A new rivet-type, built-in pole shader, used only in this line of switches, is an improvement. Contacts are double-break, silver, and easily removed for inspection or replacement. Isothermic overloads are provided with a positioning spring which permits making the relay either hand or automatic reset. A holding interlock is provided and two additional inter-

How to Stop Machines from Guessing

Equip your machines with Veeder-Root Counting Devices. With these devices accurate production records are made. The starts, stops, and other machine operations are recorded. Pieces produced are counted. Volumes and lengths are measured. Positive performance facts are secured. The veil of guesswork is lifted.

Manufacturers of hundreds of machines used by industrial plants, textile mills, offices, amusement centers, railroads and many others build Veeder-Root Counters into their products for two reasons. First, they provide accurate production figures for operators. Second, they back up performance claims for manufacturers.

In other machines Veeder-Root Devices are used to create sales—devices that compute; devices that control machines and make them more automatic; counters and computers specially designed by Veeder-Root's complete engineering staff. Many of these applications are described more fully in our booklet "Counting Devices". Send for a copy and see what can be done for you.

VEEDER-ROOT Inc.

HARTFORD, CONNECTICUT, U. S. A.

OFFICES IN Boston, Chicago, Cincinnati, Cleveland, Detroit, Greenville, S. C., Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco, Montreal, Buenos Aires, Mexico City, London, Paris, Tokio, Shanghai, Melbourne

coördinated CONTROL

*Coördinate—To place in harmonious or reciprocal relation. That which is of the same order, rank, power, etc.

Better performance of any machine depends largely on the relationship of one control element to another. From the simplest relay to intricate combinations — your control problem can best be solved using the experience, research and practise of a trained staff specializing in the design and production of coordinated controls.

COMPLETE CONTROL ASSEMBLIES

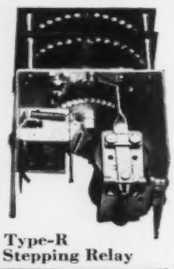
designed and built by experienced hands—will cut experimental costs to a minimum—speed deliveries!

Cut experimental costs to a minimum by submitting your control problems to Guardian Electric. Whatever you need—from the simplest small relay to complete control assemblies—can be compactly designed, completely fabricated and tested at Guardian—delivered ready for mounting in your machine.

Any Quantity AS You Want Them — WHEN You Want Them!

Let Guardian engineers work with you . . . for you. Ask us to make specific recommendations.

Write for Catalog "D" Today!



Type-R Stepping Relay

GUARDIAN ELECTRIC

1621 W. Walnut St. Chicago • Illinois

REX-BELLOWS STAINLESS STEEL UNITS

Rex-Bellows Units have all the qualities of 18-8 stainless steel—corrosion resistance and durability; higher resistance to fatigue, vibration and continued bending movement. Available in fully corrugated form, and in straight and divided form as illustrated.

Fittings welded by electric resistance circumference seam welding process, forming a completely sealed, leak-proof connection free from soldered, brazed or torch welded joints of any kind. Available in standard pipe sizes from 3/8" to 2" I.D., and assembled to specifications with required fittings.

Applicable to many uses requiring flexible connections for conveying high temperature steam and high temperature gases, air and liquids.

Made in single, double and triple ply to suit the conditions involved. Also, supplied with metal braid covering to withstand higher pressures and to provide additional external protection.

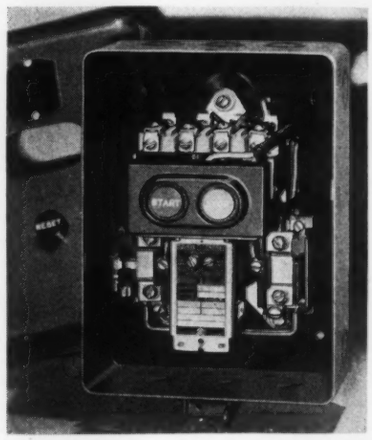
Chicago Metal Hose Corporation

Maywood, Illinois (Chicago Suburb)

locks, either normally open or normally closed, can be added.

Magnetic Starter Announced

TO MEET demand for an automatic starter for the smaller sizes of polyphase and single phase motors, the Square D Co., Detroit, announces the new size O, type R, class 8536 starter. Maximum polyphase ratings are 2 horsepower, 220, 440, 550 volts; maximum single-phase ratings are 1 horsepower, 110 volts or 1½ horsepower, 220 volts. This starter has



Starter for small motors up to two horsepower polyphase and one and one-half horsepower single phase has vertically operating magnet

a vertically operating magnet, double break silver contacts and thermal overload relays. It is offered with general purpose, dust-tight, watertight or class II, group G enclosures. It is also available as a combination starter with either disconnect switch or circuit breaker, and in the reversing type.

Attenuator Suited to Low Levels

A STUD-TYPE attenuator known as type B-31 and having design features making it especially suited to low level work has been announced by the International Resistance Co., 401 North Broad street, Philadelphia. Bridged "T," ladder or potentiometer networks are available. A spiral clockspring connector used in each arm of the bridged "T" eliminates two series pressure contacts and making for low noise level.

Carbon Steel Electrode Resists Wear

A MEDIUM carbon steel electrode, designated Hardweld 50, has been announced by Lincoln Electric Co., Cleveland. Its deposit has considerable resistance to deformation and wear and is machinable at slow speed. When deposited on straight carbon steel and allowed to cool naturally, hardness will be approximately 20 to 35 Rockwell C. The dipped coating stabilizes the arc and permits deposition of a tough, dense medium carbon steel. The deposit may be hardened by the usual water quench from above approximately 1500 Fahr., or by flame hardening methods. Best applications are surfaces requiring more resist-

¼" "HORNET"; Exceptionally compact production drill, specially designed for airplane assembly; full ball bearings; rugged gears and spindles; comfortable in the hand.
¼" "HOLGUN"; Advanced new drill of surprising compactness and ample power for production service; famous "Pistol Grip and Trigger Switch"; full ball bearing.
THE BLACK & DECKER MFG. CO.
ELECTRIC
B&D
TOOLS
TOWSON, MARYLAND
Single Row Ball Bearing
Shielded Type, Single Row Ball Bearing
Single Felt Seal Shielded Ball Bearing
"NORMA-HOFFMANN"
PRECISION BEARINGS

have been used in

BLACK & DECKER PORTABLE TOOLS

The "Holgun" and "Hornet" Electric Drills here pictured are recent additions to the distinguished line of portable tools made by Black & Decker Manufacturing Co., Towson, Md.

Like so many other "B. & D." units built in the last 20 years, these advanced tools are NORMA-HOFFMANN equipped. Armature and intermediate shafts, and chuck spindle, are carried on PRECISION BEARINGS—single-row, felt-sealed, and shielded types—at speeds ranging from 750 R.P.M. at the chuck spindle, to 14,000 R.P.M. in the motor.

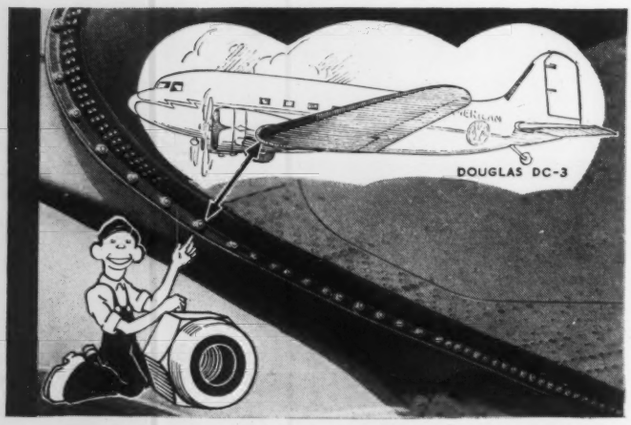
Since Black & Decker began using them in 1918, they have found that the PRECISION characteristics, high speed qualities and dependability of NORMA-HOFFMANN Bearings provide the requisite long life, smooth operation and efficiency in their units.

Since

1918

There's a PRECISION BEARING for every load, speed and duty. Write for the Catalog. Let our engineers work with you, on your bearing problems.

NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U. S. A.



SAFETIED ...with Elastic Stop SELF-LOCKING NUTS

DOUGLAS DC-3 airplane wings are joined to the center sections by bolts and Elastic Stop Nuts. Joints of this type call for an even tension on the bolts and, equally important, their proper fastening to prevent loosening. Elastic Stop Nuts for this service are not only self-locking, but permit an ease of adjustment not obtainable in other fastening means.

These nuts are available, not only to meet aircraft specifications, but also in a complete range of types, sizes, and materials, for use on any mechanical or electrical equipment.

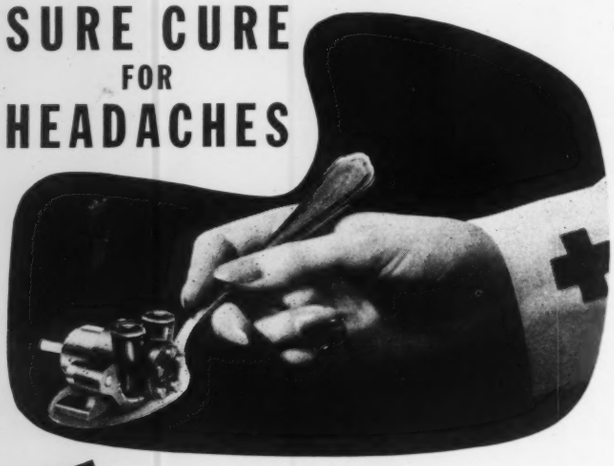
Write for Catalog and Data Book

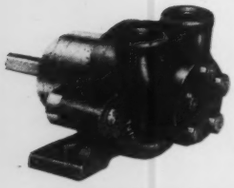
... And see the Elastic Stop Nut Exhibit in the Aviation Building at the New York World's Fair

ELASTIC STOP NUT CORPORATION
1011 NEWARK AVENUE • ELIZABETH, NEW JERSEY

THE NUT WITH THE RESILIENT LOCKING COLLAR

SURE CURE FOR HEADACHES





Here's one way to prevent pump service "headaches." Specify Tuthill Pumps for dependable, carefree performance. A type for every purpose, including Tuthill Stripped Pumps for direct incorporation into the design of your machine.

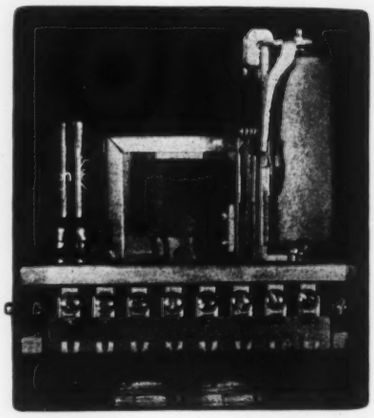
Write for Tuthill General Catalog today.

TUTHILL PUMP COMPANY
941 EAST 95TH STREET, CHICAGO, ILLINOIS

ance to deformation and wear and low carbon steel, but necessitating machining.

Electronic Switch Prevents Arcing

DESIGNED to prevent arcing and welding of contacts in thermostats, limit switches and other devices requiring low contact pressure or a limited movement, model ES-15 electronic switch has been announced by United Cinephone Corp., 43 Rawson street, Long Island City, N. Y. It is usually supplied to energize the relay when contacts are closed or the resistance becomes less than a given value. It can be supplied for the reverse operation, however, the relay being energized when the contacts are open or the resistance becomes more than a given value.



Electronic switch usually energizes relay when contacts are closed but it may operate when contacts are open

Meetings and Expositions

Oct. 15-21—

Automobile Manufacturers association. Fortieth annual national automobile show, to be held at Grand Central Palace, New York. Additional information may be obtained from headquarters at General Motors building, Detroit.

Oct. 16-18—

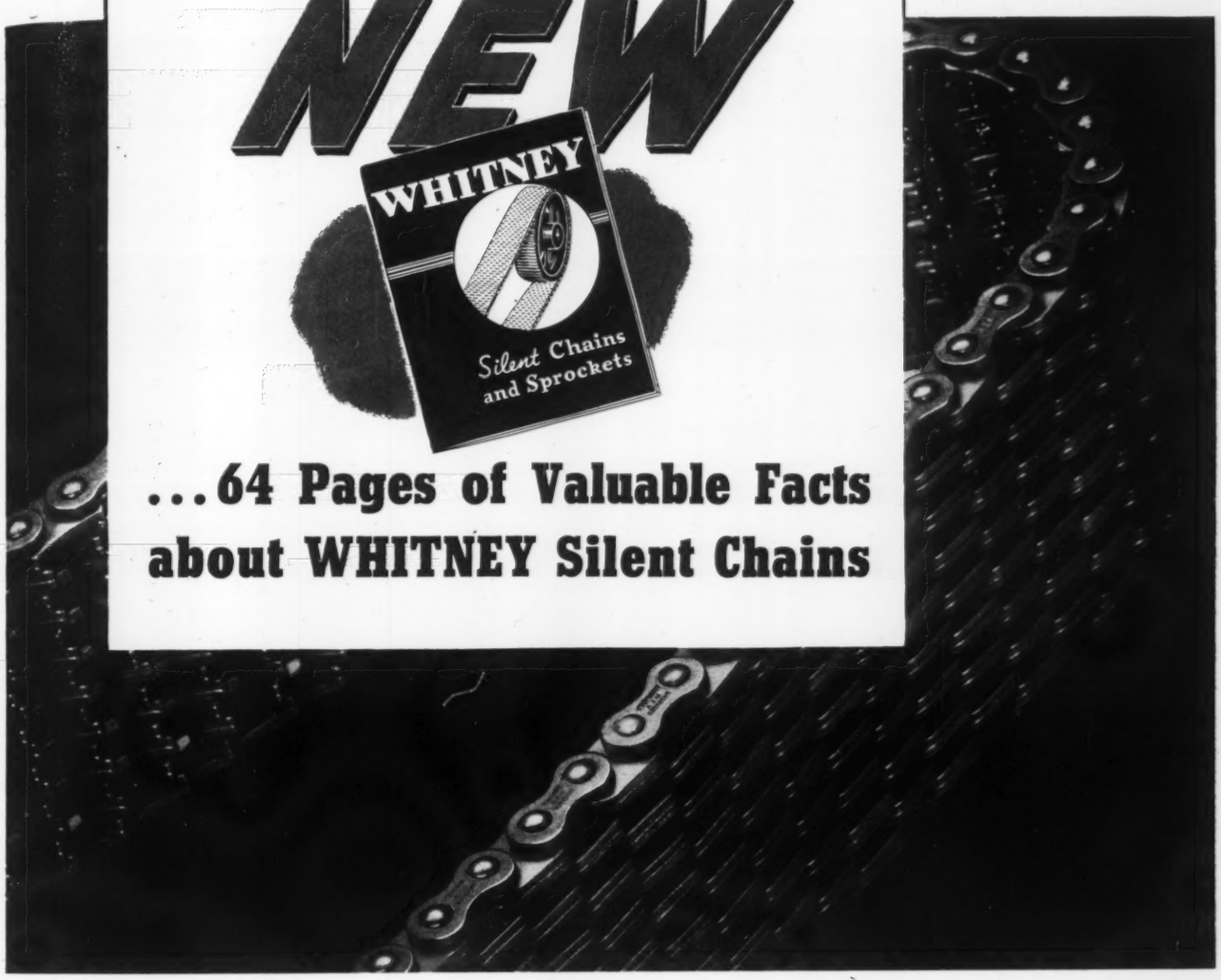
American Gear Manufacturers' association. Twenty-second semiannual meeting to be held at Whitcomb Sulphur Springs, St. Joseph, Mich. J. C. McQuiston, 602 Shields building, Wilkinsburg, Pa., is manager-secretary.

Oct. 23-27—

American Society for Metals. National Metal Exposition to be held in conjunction with the annual meeting of the society in the International Amphitheater, Chicago. W. H. Eisenman, 7016 Euclid avenue, Cleveland, is secretary.

NEW

...64 Pages of Valuable Facts about WHITNEY Silent Chains



You'll want this new catalog at your finger tips whenever problems on chain drives come up. And for good reason. It covers important questions on the selection, installation, and maintenance of silent chains . . . gives tables and formulas for determining chain lengths, widths, pitch, etc . . . lists in convenient tabular form full specifications for Whitney silent chains and sprockets . . . illustrates dozens of proven Whitney applications. Moreover, a quick-finding index makes any desired data instantly available.

On your next drive job, a Whitney engineer will be glad to go over your problem and prepare recommendations. And for your copy of the new catalog, just drop the coupon in the mail. No obligation.

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Hartford, Connecticut, U. S. A.

WHITNEY CHAINS

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Gentlemen:
Please send me your new catalog on silent chains and sprockets.

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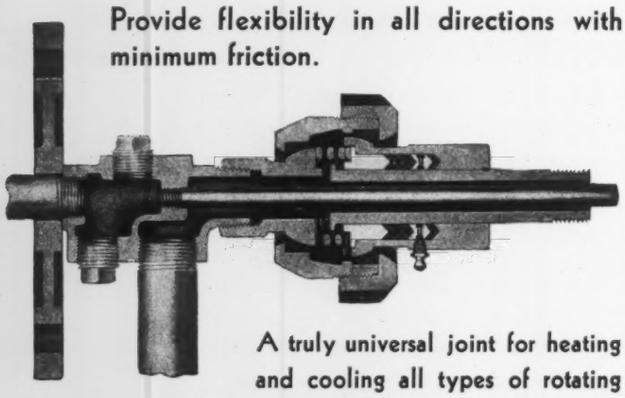
REVOLVING JOINTS

Provide flexibility in all directions with minimum friction.



A truly universal joint for heating and cooling all types of rotating rolls. Eliminates packing troubles due to strains in ordinary stuffing boxes.

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In Canada: The Holden Co., Ltd.

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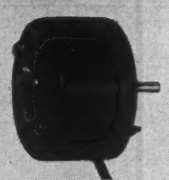
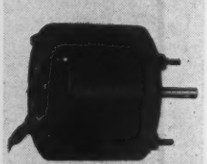
Super-Power
MOTORS



MODEL M41



MODEL M35

MODEL M6

SHADED POLE . . .
. . . Induction Type

Victor offers an outstanding line of quality-built motors of fractional power ranging from 1/200 to 1/10 H. P. Ideal for such applications as fans, blowers, animated displays, timing devices, etc. Years of successful motor building — equipped to solve difficult engineering problems. Write for literature today!

Manufacturers' Representatives:
A few territories not yet assigned. If interested, write us at once.

VICTOR ELECTRIC PRODUCTS, INC.
3040 Robertson Avenue Cincinnati, Ohio

MANUFACTURERS' *publications*

ALLOYS (MAGNESIUM)—A new data book containing important and late information concerning the forming of Dowmetal has been published by The Dow Chemical Co., Midland, Mich. Examples of operations discussed are forming of extruded shapes, power pressing and drawing, roll forming and die drawing, spinning and bending.

CLUTCHES—A 4-page leaflet has been published by Dawes Equipment Inc., Penobscot building, Detroit, giving details on construction and applications of the new D-E automatic centrifugal clutch for all kinds of industrial power drives. A clutch and flexible coupling are combined in a simple, rugged design.

CLUTCHES—Fawick-General Co., Akron, O., has published an illustrated booklet in color describing its Airflex clutch, which has a rubber gripping surface copied from the "Squeegee" tread of the General tire. The clutch also acts as a flexible coupling. Advantages and details of the clutch are outlined and some typical installations discussed.

CONTACTORS—For use with spot, projection, butt and flash welding, ignitron contactors for rapid closing and opening of the primary circuit of a resistance welding machine are described in publication GEA-3058A, issued by General Electric Co., Schenectady. An explanation of the ignitron tube operation is given, along with ratings, dimensions and a full description of the contractors.

CONTROLS (ELECTRICAL)—Many types of electric motor starters and controls for motors up to 800-horsepower are illustrated and described in booklet 88, published by Electric Controller & Mfg. Co., Cleveland. Custom built, these controls are designed to meet a definite problem or to fulfill a customer's specifications.

CONTROLS (ELECTRICAL)—"Snap-Lock" limit switches are described and illustrated in bulletin 3904, published by The National Acme Co., Chronolog division, Cleveland. These switches were developed by National Acme originally for use on multiple spindle automatic bar and chucking machines.

CONTROLS (SOLENOID)—A new catalog featuring custom-built solenoids, coils and transformers has been issued by Dean W. Davis & Co. Inc., 545 West Fulton street, Chicago. Graphs give technical information, and illustrations of solenoids in modern machines are included.

DRIVES (CHAIN)—Complete information for selection and design of silent chain drives is contained in 64 pages of catalog V-135, published by The Whitney Chain & Mfg. Co., Hartford, Conn. Engineering data, dimensions, horsepower ratings, and sprockets data, as

TODAY'S HIGH-SPEED MACHINES

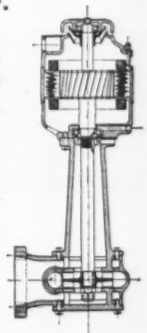
Demand the Pump of Tomorrow

THE GUSHER COOLANT PUMP

Modern rush orders demand fool-proof flow of coolant. Ruthman ball-bearing gushers—modern in every way answer your problem. Put Ruthman Gushers on your machines and your coolant worries are over.

Model No. 11020A

Gusher Pumps are modern in every respect. Gushers have split-second control, will handle materials that contain grit and abrasives. Gushers are self-cleaning and are hydrostatically balanced. Gushers will add beauty to your machines.



Model No. 11022 Patented and Patents Pending

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USE "GUSHERS"

Write for Engineering Specifications

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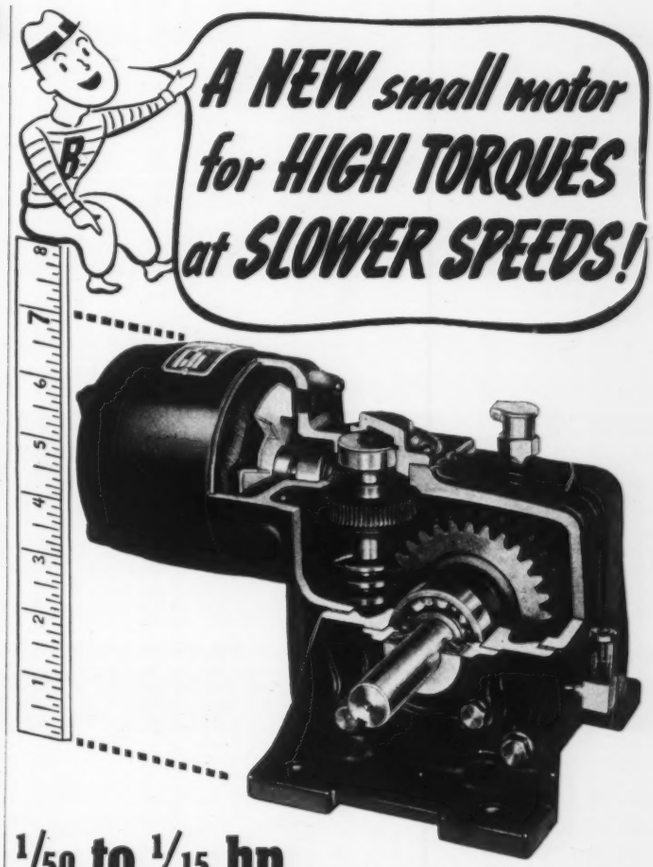
FREE DEMONSTRATION BLUEPRINT AND SAMPLE TURQUOISE PENCIL

You can save the time and trouble of costly inking in. This smoother, stronger, accurately graded drawing pencil is also so opaque and uniform that every line blueprints perfectly. Write for Demonstration Set, mentioning desired grade of pencil, this publication, and your supplier's name. **EAGLE PENCIL CO., 703 E. 13th St., N.Y.C.**

EAGLE "Chemi-Sealed" TURQUOISE (SUPER BONDED)



1/50 to 1/15 hp

Here's a sturdy, compact line of fractional horsepower speed reducer motors—the 30RJ—that provides high torques at very slow speeds. In 23 standard ratios. Available in every type of winding. All gears, worms, and shafts are precision built for permanent alignment—assuring silent, efficient operation.

Speeds to 0.6 rpm—Torques to 350 in-lb

Ball bearings throughout provide long, trouble-free life and reduce friction. Bearings are designed for reversing duty and are ruggedly built to handle overhung loads. Bodine also offers a full line of fractional horsepower motors with and without speed reducers.

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Bodine Electric Co., 2258 W. Ohio St., Chicago
Please send me your new bulletin on 30RJ motors.

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Company .....
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ENGINEERED FOR YOUR PRODUCT

HYDRON
Metallic Bellows

HYDRON Metallic Bellows are used as control elements in temperature-and-pressure-control devices, and for liquid or gas seals of compressors and pumps. We are specialists in the design and production of complete thermostatic and pressure units for temperature and pressure controls. We are, therefore, prepared to extend the fullest co-operation to engineering departments of control manufacturers in the solution of design and engineering problems.

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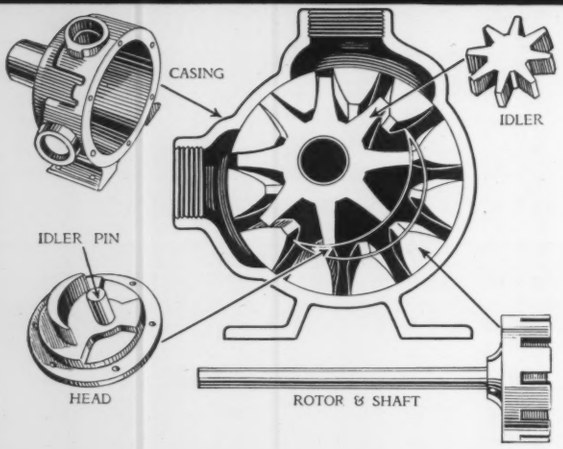
BOSTON CHICAGO DETROIT LOS ANGELES
PRODUCERS OF BELLOWS EXCLUSIVELY
SERVING AUTOMATIC CONTROL MANUFACTURERS

THAT'S ALL . . .
There Isn't Any More!



Count 'em . . . only 5 parts in all—and *only 2 moving parts.* Real simplicity isn't it? And this simplicity is Viking's guarantee for longer life, fewer repairs, downright economy. For bulletins and prices get in touch with the Viking Office or Representative nearest your plant . . . or write direct to the Viking Factory.

VIKING PUMP CO.
CEDAR FALLS, IOWA.

well as illustrations of typical drives in various industries are included.

DRIVES—An explanation of principles underlying the operation of pivoted drives is included in booklet No. 861, issued by Rockwood Mfg. Co., 1801 English avenue, Indianapolis. Price and dimensional information is presented.

HOSE (FLEXIBLE)—Anchor Coupling Co. Inc., Waukegan, Ill., has published new bulletin sheets describing high pressure flexible oil lines for hydraulically operated equipment. Hose sizes and coupling threads are listed.

INSULATION (FIBER)—Vulcanized fiber for cord insulation wherever current-carrying wires pass through metal is described and illustrated in a new folder issued by Wilmington Fibre Specialty Co., Wilmington, Del. Grommets, washers and bushings are treated.

MOTORS—Totally enclosed, fan-cooled induction motors, rated from two to 75-horsepower, are described in publication GEA-1326D, issued by General Electric Co., Schenectady. Elements making up the motors are shown in cutaway views and fully explained. Characteristics are listed.

MOTORS—Squirrel cage and totally-enclosed, fan-cooled motors are illustrated and discussed in detail in brief specification folders ranging from S-41 to S-48, issued by The Imperial Electric Co., 64 Ira avenue, Akron, O. Particular attention is called to the types of applications for which the motors are intended.

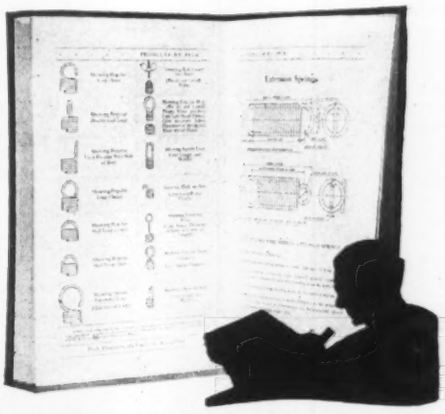
MOTORS—Single-phase motors in a new line are described in an illustrated leaflet issued by Sterling Electric Motors Inc., Los Angeles. Different types are illustrated and copy gives the most important features of design and construction.

STEEL—General data book issued by Joseph T. Ryerson & Son Inc., Chicago, includes metallurgical definitions; heat, hardness and numerical equivalent tables; weight, dimension and specific gravity tables; and carbon steel, drill rod, nonferrous, tubing, sheet and manufacturing tolerances.

TRANSMISSIONS (VARIABLE SPEED)—Allis-Chalmers Mfg. Co., Milwaukee, in its new 20-page Vari-Pitch speed-changer bulletin, B-6013, presents a story with pictures and information to show how its units help in "Keying Production to Profits." The bulletin covers manual and electrical remote controlled units, dimension sheets, horsepower and speed range tables.

VALVES—Check and foot valves for water, gas, oil and air are described in a four-page booklet published by White Machine Works, Sixth and Harrison streets, Fort Wayne, Ind. Principles of design and details of construction are treated, and specifications and prices are listed.

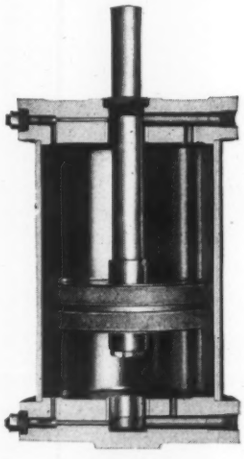
WIRE ROPE—Hazard Wire Rope division, American Chain & Cable Co. Inc., Wilkes Barre, Pa., has published pocket-sized catalog No. 20, virtually a handbook on wire rope. It contains information both practical and technical and includes list prices and specifications of various constructions of wire rope.



KEEP IT IN REACH OF YOUR PRODUCT DESIGNERS

THE Peck manual & catalog can be of much help to your product designers and engineers in selecting the right spring for the job. It has idea-provoking illustrations of all types of wire springs; fundamental spring forms, ends & connections; hints for ordering, etc. Also useful data on screw machine parts. The book is free, but please make request on your letter head.

PECK SPRINGS
AND SCREW MACHINE PARTS
The Peck Spring Co., 10 Wells St., Plainville, Conn.



TOWARD YOUR BETTER PRODUCT

T-J

announces . . . .

HARD CHROMIUM PLATED *cylinder walls and piston rods.*

During intervals of non-use and before installation, cylinders are ordinarily susceptible to rust. From the various methods of preventing this condition, Hard Chromium plating was selected because, in addition to its ably solving the rust problem, it becomes an important factor in increasing the efficiency of the cylinder. The same moisture (from the condensation of compressed air) or water (when the cylinder is used for water-hydraulics) which would ordinarily cause corrosion, now acts as a lubricant on these hard chromium plated bodies and piston rods actually increasing the "slickness" of the surface. This in combination with the polished, smoother surface obtained means less friction and prolonged packing life. Of no less importance is the fact that these cylinders with this new feature are now being furnished *at no extra cost*.

More "service" features are described in our catalog No. 36-A. It will assist you in selecting the type of cylinder that will help you *toward your better product*.

this is a* TOMKINS-JOHNSON *product

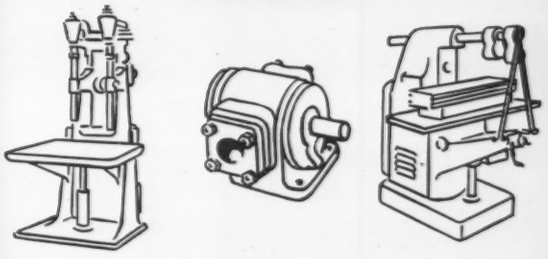
Factory at 618 N. Mechanic St., Jackson, Michigan. Agents in principal cities. T-J products also include Oil Hydraulic Cylinders . . . . Remote Control Systems . . . . Rotating Chucks and Cylinders . . .. Rivitors . . . . Clinchors . . . . Special Equipment . . . . Brownie Coolant Pumps . . . T-J Die Sinking Milling Cutters.

Is Your Product SUBJECTED TO

TORSION? as in Drill Presses

CENTRIFUGAL FORCE? as in Centrifugal Pumps

SHEARING? as in Milling Machines



Then BRISTO is your answer for a TIGHTER, STRONGER SET-UP!

Thanks to the Bristo multiple spline socket head design—a design long-proved in industry for positive power transmission—Bristo Socket Screws give good service even in applications where the severest stresses are encountered. They set up tighter without danger of splitting or shearing or rounding out. More than that, Bristos stay tighter, hold better. Result—delays ended. Motion saved. Assemblies speeded and production costs lowered.

Make Bristos your socket screws. Write for samples and Bulletin 83-5N. No obligation whatever. The Bristol Company, Mill Supplies Division, Waterbury, Conn.

FEATURES AT A GLANCE!
MULTIPLE SPLINE SOCKET—as positive acting as meshed gears—Won't split, shear, strip, round out, slip or jam—Sets tighter with less effort—No loosening under vibration—Takes wrench without fumbling or skidding.

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Multiple Spline
SET AND CAP SCREWS

Approved by the American Standards Association and the American Society of Tool Engineers

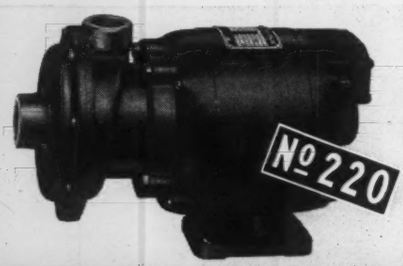
BRISTO MAKES YOUR PRODUCT BETTER

for Supplying Coolant . . .

or for light transfer work

—Two New Centrifugal Motorpumps

Modern—
Compact—
Flexible in Installation . . . can be mounted either horizontally or vertically.



No. 240 has flange mounting integral with base... eliminating inlet piping.

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Brown & Sharpe Mfg. Co.

B&S Providence, R. I., U. S. A.

BROWN & SHARPE PUMPS

Gear Specialties

—the 'tough' jobs—

—such as these, and numerous other types in the finer Pitches—14 to 96 D. P.—are the logical product of a skilled organization with a deft "feel" for *precise* work. Note the *Combination* Worm-gear, rotating as a Gear on one side and as a Worm on the opposite side.

SPURS SPIRALS	BEVELS RATCHETS	WORM-GEARING
Made to order only	*No stock*	*No catalog*

Gear Specialties

INCORPORATED

CHICAGO

2670 W. MEDILL AV. Phone Humboldt 3482

Business and Sales Briefs

ALL the business and net assets of Baldwin-Duckworth Chain Corp., Springfield, Mass., have been acquired by Chain Belt Co., Milwaukee, manufacturers of sprocket chain. The newly-acquired plants at Springfield and Worcester, Mass. will retain their identity and will be known as Baldwin-Duckworth, division of Chain Belt Co. Frank J. Weschler has been appointed general manager, and George Gilbert, general sales manager of the Baldwin-Duckworth division.

♦

General Plastics Inc., North Tonawanda, N. Y., has changed its name to that of Durez Plastics & Chemicals Inc. There will be no change in its management.

♦

A complete technically trained field staff under G. H. Robertson has been made available by Sherwin-Williams Co., to serve manufacturers in connection with their finishing problems. The staff consists of the following appointments: G. L. Hehl, formerly plant superintendent at Newark, N. J., as eastern manager of industrial sales; H. S. Sherman, formerly of Cleveland Technical Service Staff, as representative in North Central and South Central districts; and Lyman Weber, formerly of Chicago, in western, southwestern and Mississippi valley districts.

♦

Union Carbide & Carbon Corp. board of directors approved an agreement for the acquisition of all the assets of Bakelite Corp., co-ordinating technical knowledge, research and production methods, and distribution facilities of the two organizations. Improvement of existing products, development of new plastics and other compounds and new uses for such materials, will be undertaken by the combined organization. There is no change in the Bakelite personnel, and the company will continue to do business at its present address, 247 Park avenue, New York.

♦

Metallizing Co. of America Inc., Los Angeles, has announced the opening of a sales and service office at 602 Academy building, 17 Academy street, Newark, N. J., in charge of William McMakin. Complete parts on Mogul metallizer guns as well as metallizing wire are available. Engineering service concerning metallizing problems will also be given.

♦

Fred G. Gronemeyer has been promoted to plant manager of the Springfield, Mass., plant of the plastics division of Monsanto Chemical Co., St. Louis. He has been resident engineer for the plant since early this

(*Concluded on Page* 88)

SpeedWay

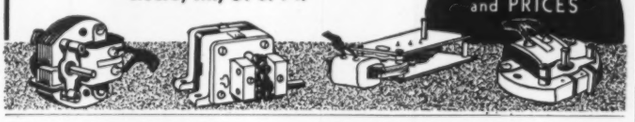
Worm Drive
Back Geared
FLEA POWER MOTORS
110 VOLT
AC, DC,
or Universal

Low Cost made possible by improved designs, large quantity production and production methods . . . Dependability developed thru hundreds of different applications in the field . . . Stamina built-in for continuous operation and . . . . . High torque developed thru integral back gearing . . . . Cased or skeleton types with standard gears that give "any" speed, that save engineering, cost, and space of requirements of auxiliary speed reducing means . . . . Single drives, double drives—from top, bottom, right or left. Miniature motors for a hundred uses; motors that make *automatic* tuning, *automatic* opening and closing, automatic features that make sales at incidental costs.

Sold singly, in dozens, thousands or millions.

SPEEDWAY MFG. CO.
1858 S. 52nd Ave.
Cicero, Ill., U. S. A.

WRITE for SPECIFICATIONS and PRICES



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THE PROFESSIONAL JOURNAL OF CHIEF ENGINEERS AND DESIGNERS

MACHINE DESIGN is devoted exclusively to design problems and development of ideas for engineers and executives in the field of machinery manufacture.

Over 30,000 design engineers and executives in more than 7,600 machinery manufacturing plants read MACHINE DESIGN regularly.

The first publication to devote its editorial content exclusively to discussion of machinery design problems, MACHINE DESIGN remains the only one whose contents, distribution and readership are concerned alone with the design and redesign of machinery.

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Perfect Control . .

TRU·LAY
PUSH-PULL CONTROLS

SCORE EVERY TIME

● These modern controls are making perfect scores, every time they are used, on countless varieties of mechanisms.

They operate smoothly, positively, accurately every time you call upon them to transfer motion from stationary to moving points.

You can snake them around or through obstructions of any kind. They eliminate the toggles, bellcranks, rods, pins and other parts which require constant adjustment and replacement as wear makes them noisy and "sloppy."

You should read the interesting booklet, "The Key to Remote Control." Write for your copy today.

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See our exhibit, in Metals (Products) Building, opposite the Perisphere and Trylon, New York World's Fair

ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.
In Business for Your Safety

Unbreakable OILERS
MODERN! VISIBLE!
AUTOMATIC!
STREAMLINED!
TRICO OPTO-MATIC OILERS
• Maintain a constant level in bearings, gear and pump housings, etc.
• Improve the appearance and efficiency of any machine.
• Create new markets and add prestige.
• Reduce sales resistance and insure accurate, dependable lubrication after the equipment is in service.
Let us help you modernize your equipment—
Write for Bulletin No. 25
TRICO
TRICO FUSE MFG. CO. Milwaukee, Wis.

6 HORSE POWER
IN A SMALL PACKAGE
AIR-COOLED
12 Sizes—all light weight—1 to 35 H.P.
This highly efficient sidewalk finisher is powered with a single cylinder heavy-duty WISCONSIN air-cooled engine of extremely compact design. For new modern machinery where space, weight and cost are serious problems, we have all the answers for you.
Further Details on Request
HEAVY DUTY AIR COOLED ENGINES
WISCONSIN
MOTOR CORPORATION
MILWAUKEE • WISCONSIN

★

Acknowledgment

★

Machine Design takes this opportunity of thanking all those companies and individuals who cooperated in the compilation of the accompanying directory of engineering materials, stitched into the center of this October issue. We are particularly indebted to the manufacturers of the materials for their response to requests for information on their products, and to the advertisers whose collaboration made possible the presentation.

★

NOW

you can give the machines you design added protection against accidents and breakdowns

Ordinary set screws that work loose during the operation of machinery on which they have been applied have long been a constant source of bother, requiring frequent check-ups to forestall a breakdown. Now, it's easy to eliminate this hazard.

Fig. 1641
Pats. Pend.

UNBRAKO

SELF-LOCKING HOLLOW SET SCREWS

with the knurled points, automatically lock in place when tightened up in the normal way with the usual hex bar wrench. Removal, if necessary, for making adjustments is also made in the usual manner and the screws re-used any number of times. So cleverly has the knurling been placed that no resistance is offered during setting up or unwinding.

Fig. 1645
Pats. Pend.

Write now for a copy of our new "Unbrako" Catalog. It contains full information about these and other "Unbrako" Socket Screw Products. It's yours for the asking.

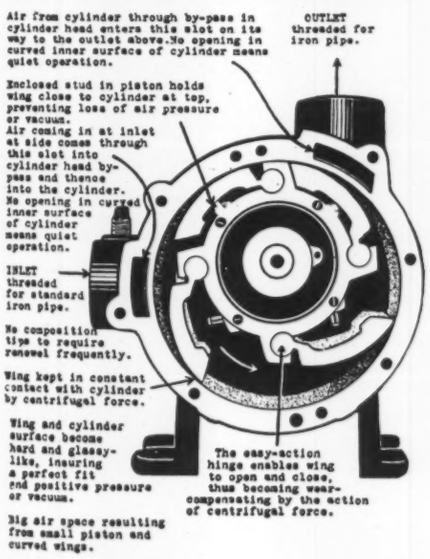
STANDARD PRESSED STEEL CO.

BRANCHES: BOSTON, DETROIT, INDIANAPOLIS

JENKINTOWN, PENNA.
BOX 102

BRANCHES: CHICAGO, ST. LOUIS, SAN FRANCISCO

Standard Equipment on all sorts of Air Using Devices and used by the world's leaders . . . . .


Air from cylinder through by-pass in cylinder head enters this slot on its way to the outlet above. No opening in curved inner surface of cylinder means quiet operation.
OUTLET threaded for iron pipe.
Enclosed stud in piston holds wing close to cylinder at top, preventing loss of air pressure or vacuum.
Air coming in at inlet at side comes through this slot into cylinder head by-pass and thence into the cylinder. No opening in curved inner surface of cylinder means quiet operation.
INLET threaded for standard iron pipe.
No composition tips to require renewal frequently.
Wing kept in constant contact with cylinder by centrifugal force.
Wing and cylinder surface become hard and glassy-like, insuring a perfect fit and positive pressure or vacuum.
Big air space resulting from small piston and curved wings.
The easy-action hinge enables wing to open and close, thus becoming wear-compensating by the action of centrifugal force.

LEIMAN BROS.
PATENTED
ROTARY
AIR PUMPS
PRESSURE
VACUUM
for use with
GAS AND OIL
BURNERS

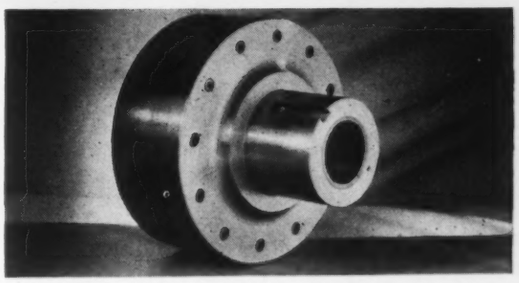
PAPER FEEDERS
Bottle Fillers
GAS MACHINES
AUTOMATIC
DEVICES
MANY
SIZES

A Machine That Takes Up Its Own Wear Automatically

LEIMAN BROS., INC. 23 Walker St. NEW YORK CITY

MAKERS OF GOOD MACHINERY FOR 50 YEARS

HILLIARD CLUTCHES



The Hilliard Over-running Clutch has Four Important Functions:

1. Automatic dual drive operation of any equipment with any type of prime movers.
2. Automatic operation of 2-speed drive.
3. As a ratchet, permitting infinite adjustment.
4. As an automatic back-stop.

FURNISHED IN 48 TYPES - Sizes from ⅓ to 340 H.P. at 100 R.P.M.

Write for booklet giving full information

THERE'S A HILLIARD CLUTCH FOR EVERY JOB!

OVER-RUNNING..SINGLE REVOLUTION..FRICTION..SLIP..SPECIAL

THE HILLIARD CORPORATION
103 WEST 4TH ST. ELMIRA, N. Y.

(*Concluded from Page* 84)

year, and previously, since July, 1938, he was development engineer for the plastics division plant.

♦

Formation of Eagle Plastics Corp., located at 135 Walton street, Brooklyn, N. Y., has been announced. The new compression molding company will be headed by E. R. Heckman, executive vice president and general manager.

♦

A direct factory sales office has been opened in New York, by Universal Gear Corp., Indianapolis. M. E. Robbins, assistant director of sales, has been placed in charge of the Eastern district.

♦

Allis-Chalmers Mfg. Co., Milwaukee, has opened branch offices in the following cities: Louisville, Ky., under the supervision of W. E. Kercheval; and at La Porte, Ind., under direction of B. L. Margeson.

♦

Associated with Timken Roller Bearing Co. Ltd., Toronto, for twenty years, Charles E. Webster has been named general manager.

♦

Arthur N. Vogt, associated with the company since 1933 in the sales department, has been appointed district sales manager for the Youngstown district of Youngstown Sheet & Tube Co. Mr. Vogt has been in charge of Yoloy high tensile steel sales since the development of this material. Formerly he was connected with Associated Alloy Steel Co., Cleveland and Central Alloy Steel Co., Massillon, O.

♦

A sales convention was recently held by the Foote Bros. Gear & Machine Corp., Chicago, for all the company's representatives. Talks and papers of an educational nature as well as information as to the company's products and their application were given. The convention was conducted by F. A. Emmons, vice president and general sales manager of the company, while F. H. Fowler, president and general manager, made the opening address.

♦

To further improve its service to the oil industry and other users of the company's products in the southwest, American Chain & Cable Co. recently put into operation a modern manufacturing plant and warehouse at Houston, Tex.

♦

Detroit Ball Bearing Co. of Ohio, Toledo, has become the successor to Ohio Ball Bearing Co. The firm, specializing in antifriction bearings and devices for industrial applications, will be managed by G. E. Binkelman, formerly with Timken Roller Bearing Co.

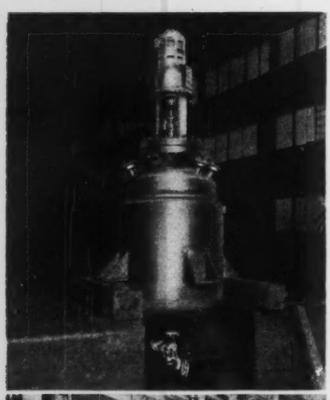
♦

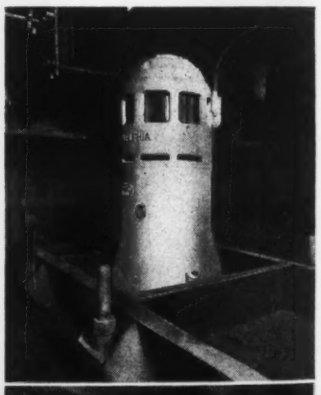
Formerly connected with the Cleveland district office of Allegheny-Ludlum Steel Corp., Pittsburgh, Kenneth T. French has been placed in charge of the company's newly-established warehouse in Toledo, which will carry stocks of stainless steel and Ludlite.

The **ONE** Vertical Drive that has **EVERY** Advantage

THE PHILADELPHIA

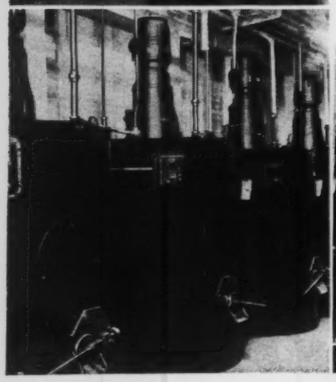
MOTOREDUCER

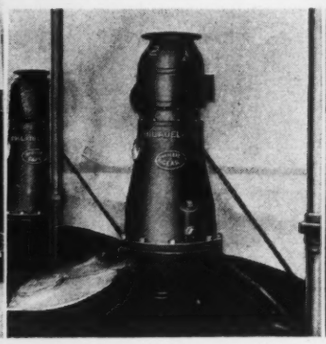


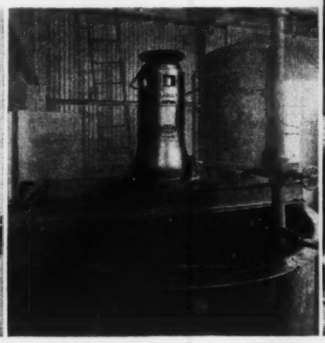


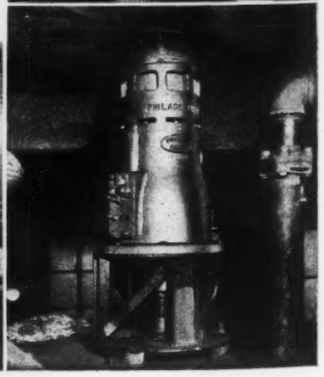
Economy . . . based on highly efficient, trouble-free operation. Rigid construction, with proper bearing arrangements, assures freedom from undesirable whipping action, vibration or undue noise. Sturdy housings . . . tight against surrounding conditions. Dependable leak proof lubrication. Perfect service with practically no attention. Get our MotoReduceR catalog for full details.

Photos viewing counterclockwise . . . operating
(1) Autoclave (2) Agitators (3 and 4) Mixers
(5) Chilling Tank (6) Agitator.









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Gasoline Motors that have Everything

In Briggs & Stratton 4-cycle, air-cooled gasoline motors you will find "everything"

ADVANCED DESIGN and finest engineering.

PERFORMANCE, DURABILITY—noted for trouble-free, easy starting, dependable, economical service.

ADAPTABILITY—broad line of models, ½ to 5 HP, easily adaptable to any machine — a *right model for every job.*

AUTHORIZED SERVICE STATIONS throughout the United States and Canada. Many in foreign countries.

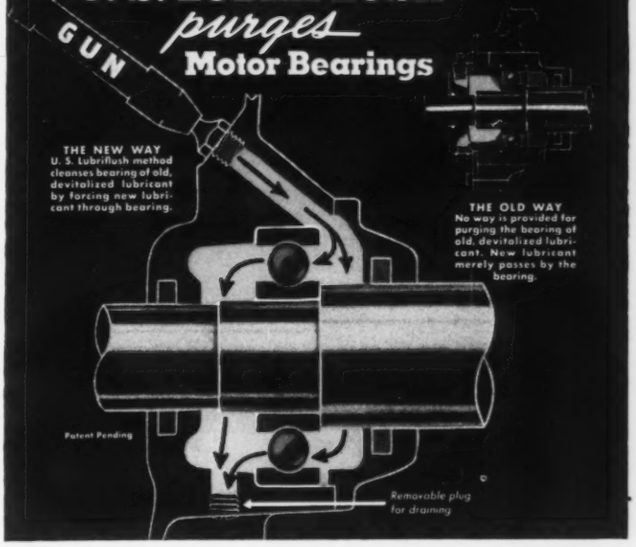
A NAME—internationally recognized and accepted.

BRIGGS & STRATTON CORP.
Dept. MD-1039, Milwaukee, Wis., U. S. A.

Also builders of Industrial Variable Speed Transmissions — Automotive Equipment — Automatic Air-Saver.

It's Powered RIGHT when it's Powered by
4 CYCLE BRIGGS & STRATTON GASOLINE MOTORS

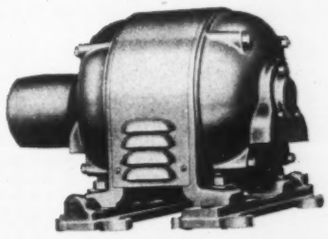
U. S. LUBRIFLUSH *purges* Motor Bearings


GUN
THE NEW WAY
U. S. Lubriflush method cleanses bearing of old, devitalized lubricant by forcing new lubricant through bearing.
THE OLD WAY
No way is provided for purging the bearing of old, devitalized lubricant. New lubricant merely passes by the bearing.
Patent Pending
Removable plug for draining

Most advanced method of thoroughly cleansing bearings

Here indeed is a revolutionary improvement in the lubrication of motor bearings. U. S. Lubriflush allows new lubricant to be introduced to the innermost recesses of the bearing, forcing the old, worn-out lubricant from the bearing and out of the motor through a bottom drain. The bearing is purged of sludgy, devitalized grease, and renewed with clean lubricant. Bearing life is greatly increased. The U.S. Lubriflush system eliminates the necessity of disassembling the bearing to cleanse it.

No extra charge is made for Lubriflush if specified on your order.



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An interesting Bulletin describing the new U. S. Lubriflush system in comparison with ordinary motor bearing lubrication will be mailed on request. Mail the coupon.

U·S·MOTORS

REQUEST FOR LUBRIFLUSH BULLETIN

U. S. ELECTRICAL MOTORS, INC.
84-34th St., Brooklyn, N. Y.
Gentlemen:

☐ Mail U. S. Lubriflush Bulletin ☐ Mail U. S. Motors Bulletins

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Address_____

City_____ State_____

POSITIONS

AVAILABLE OR WANTED

WANTED—Engineering Executive must have years of experience designing and estimating hydraulic presses and controls. Address Box 121, MACHINE DESIGN, Penton Building, Cleveland, Ohio.

CLASSIFIED advertisements are set in eight point Stymie bold face type, approximately eight words to a line. Rates are as follows:

Positions Available—20c a word, with a minimum charge of $10.00, which permits the use of fifty words.

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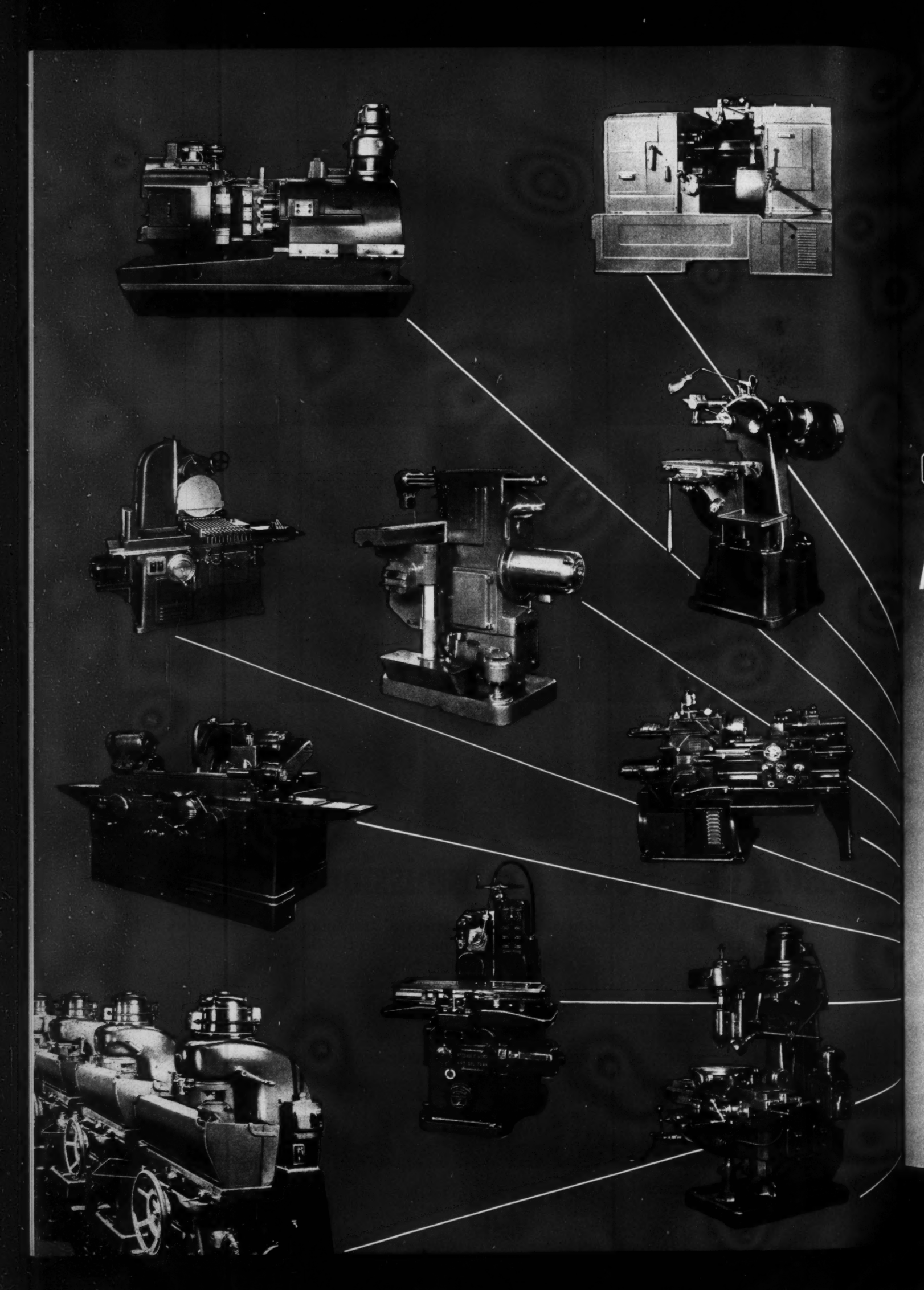
Boston Gear Power Transmission Equipment

Designed and built to give you maximum satisfaction at minimum cost. Carried in stock in types and sizes suitable for almost every kind of application involving the mechanical transmission of power.

With the exception of Oilite Bearings, complete descriptions, specifications and list prices of the equipment shown here will be found in the Boston Gear general catalog No. 52. Complete data on Oilite Bearings is contained in a booklet, Form 1-39, devoted exclusively to that product.

Your free copies of either or both of these publications gladly sent on request.

BOSTON GEAR WORKS, INC. NORTH QUINCY, MASS.



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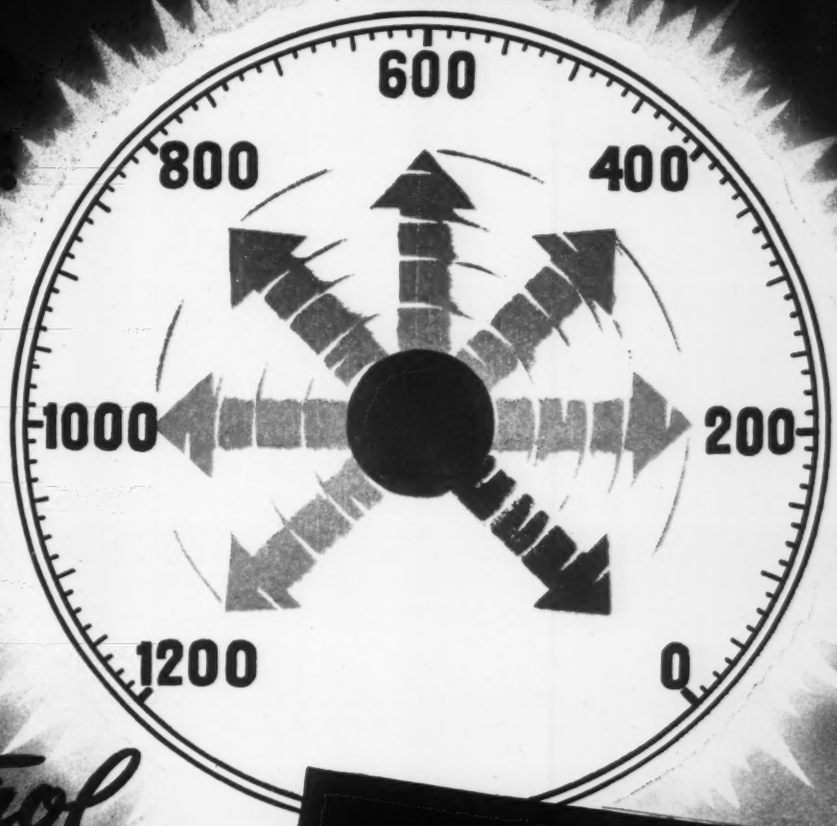
GIVES ALL SPEEDS TO ZERO



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BRIGGS & STRATTON
TRANSMISSION

Accurate *Speed Control* Vital in These Applications

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Wide range—speed shiftable when stationary — full torque down to zero are important Briggs & Stratton Variable Speed Transmission advantages for conveyor drives.

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Briggs & Stratton Variable Speed Drives greatly extend the usefulness of pumps by providing everyday ranges up to 20:1 and more.

Feeders

Briggs & Stratton Variable Speed Transmissions on proportioning feeders give a useful range of delivery up to 50 to 1 with hairline accuracy to dial setting. These units do more and reduce feeder costs.

Printing Presses

Another application where extremely accurate control of speeds down to zero sets new standards. Make-ready, running — inching without stopping the motor — all printing operations are simplified with Briggs & Stratton Variable Speed Drives.

Welding Tables

On rotating chucks for speeding up welding operations — Briggs & Stratton Variable Speed Drives give the extreme speed range needed—fine adjustment — accurate regulation.

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Send for bulletin TP 401, which describes and illustrates Briggs & Stratton Variable Speed Transmissions.

SPECIFICATIONS

Dimensions — no bigger in diameter and no longer than the motor — no added fastenings required.

Drive — available with built-in motor or with shaft extension for coupled motor or offset drive.

Input Speed — maximum of 1800 RPM in smaller units — 1200 RPM in larger sizes — or can be connected to shaft of machine to run at low input speed.

Delivered Speeds — (with 1200 RPM input) in infinite steps from 330 RPM to 0 in standard types; from 165, 80 or 45 to 0 in built-in gear reduction types; or, from 1320, 1100, or 660 to 0 in built-in gear step-up types.

Overhung Loads — full chain pull capacity corresponding to torque rating.

Control — standard manual, remote manual, remote electric or lever.

All-Metal — splash lubricated, runs in oil, no belts.

Prices — comparable to conventional drives.

BRIGGS & STRATTON CORPORATION, Milwaukee, Wisconsin, U.S.A.

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Also Builders of: 4-CYCLE, AIR-COOLED GASOLINE MOTORS — AUTOMOTIVE EQUIPMENT — AUTOMATIC AIR-SAVERS